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Propagation of Pacific Northwest Native Plants:

A Manual

Volume two

FIRST EDITION

Robin Rose

Caryn E.C. Chachulski

Diane L. Haase

Rose, R., C.E.C. Chachulski, and D.L. Haase. 1996. Propagation of Pacific Northwest Native Plants: A Manual, volume two, first edition. Nursery Technology Cooperative, Oregon State University, Corvallis, OR, 73 p.

The purpose of this manual is to present a much-needed compilation of information from literature sources and personal contacts and make it widely available. This is Volume II of the manual. A third volume is planned for early 1997. We expect that our research will continue to yield more useful information and therefore we intend to publish a second edition at a later date.

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Introduction

This manual is the second volume of an ongoing project to present information on propagation of Pacific Northwest native plants. It includes forty new species of trees, shrubs, forbs, and grasses as well as a glossary. For each species, there is a description of the plant, its habitat and geographic range, and propagation information by seed and vegetative. As in volume one, the propagation information was pooled from various journals, books, and personal contacts. A third and final volume is already in progress and will cover 70-80 more plants, mostly grasses and forbs, and an overview of different propagation techniques. With the great popularity of volume one, and an increasing interest in and demand for native plants in forestry and ecological projects, we plan to compile all three updated volumes into a book.

Acer circinatum
Vine maple

Description:

Vine maple is a long-lived, deciduous shrub or small tree growing up to 15 m in height. The trunk is crooked and the branches either grow erect or creep along the ground before turning up. Stems are pale green to reddish brown. The simple, opposite leaves appear nearly circular with 7-9 sharply toothed lobes. They are reddish when young, turn to bright green, then orange and scarlet in late summer or fall. Flowers are found in loose, hanging clusters and are reddish-purple or white in color. The fruits are winged, rose-colored double samaras at angles of 140-180%. It is not a commercially important species, but is sometimes used as an ornamental or for firewood. Vine maple is eaten by deer, elk, cattle and sheep. The seeds, buds and flowers are a source of food for many birds and small mammals (Elias 1980, Uchytil 1989, Haeussler et al. 1990, King County 1994).

Habitat and Geographic Range:

Vine maple is very shade tolerant and grows in the understory of coniferous forests. It can be found from sea level to 1400 m in elevation and ranges from the Cascade Mountains to the coast and from southwestern British Columbia to northern California. It prefers bottomlands and rich, moist, well-drained soils and can be found growing along streambanks and alluvial terraces, in forest openings and clearcuts, and on talus slopes and the lower portions of open slopes (Elias 1980, Uchytil 1989, Haeussler 1990,).

Propagation:

Seed: Vine maple is a very poor seed producer and relies primarily on vegetative means for natural reproduction (Uchytil 1989). Vine maple begins to produce seed at an

early age, probably before age 10. The seeds should be collected by hand or by shaking the tree and collecting the samaras on a tarp. This is done in September and October as they begin to dry. Seeds require a warm, moist period of stratification at 20-30%C for 30-60 days, followed by a cold, prechilling period of 3%C for 90-180 days. Seeds can be planted in trays or beds and covered with leaf mulch. Seeds will germinate the following spring and can be transplanted after one year (USDA 1974, Haeussler 1990).

Seeds per pound: ~5,000 (Uchytil 1989)

Vegetative: Plants sprout from the root crown following top-kill from logging or burning. Layering occurs infrequently, but as plants mature some stems become too long and massive to remain erect and thus lay prostrate and root where the stem touches the ground. Seedlings growing around an abundant supply of vine maples may be dug up and potted immediately (Uchytil 1989, King County 1994).

References:

Elias, T.S. 1980. The Complete Trees of North America Field Guide and Natural History. Van Nostrand Reinhold Company, New York. 948 p.

Haeussler, S., D. Coates, and J. Mather. 1990. Autecology of common plants in British Columbia: A literature review. British Columbia Ministry of Forests. FRDA Report-158. 272 p.

King County Department of Public Works, Surface Water Management Division. 1994. Northwest Native Plants, Identification and Propagation for revegetation and restoration projects. King Co. WA.

Uchytil, R. J. 1989. Acer circinatum. In: Fischer, William C., compiler. The Fire Effects Information System [Monograph Online] . Missoula, MT: USDA, Forest Service, Intermountain Research Station, Intermountain Fire Sciences Laboratory. http://www.fs.fed.us/database/feis/plants/Tree/ACECIR. Accessed June 25, 1996.

USDA Forest Service. 1974. Seeds of Woody Plants in the United States. USDA, Agric. Handb. 450. 883 p.

Acer glabrum
Douglas maple (Rocky Mountain maple)

Description:

Douglas maple is a shade-tolerant, deciduous small tree or shrub that grows up to 9 m. The trunk is short with smooth, reddish-brown to gray bark. The leaves are simple, opposite, palmate shaped with 3-5 toothed lobes. The male and female flowers usually occur on separate trees and can be found in hanging clusters at the end of the branchlets. Fruit are paired, winged samaras usually at an angle of 45% or less. Rodents and birds eat the seeds while whitetail and mule deer browse the leaves and twigs. Due to the small size of the tree, the wood is not commercially important, but is excellent for campfires and wood stoves (Elias 1980).

Habitat and Geographic Range:

Douglas maple grows in wet sites at elevations between 1200 and 1800 m and can be found in sheltered canyons, ravines, on moist slopes, and along streams. It is commonly found on silty to sandy or gravelly and rocky well-drained soils. Due to its flexible stems it can withstand heavy snow pack and often codominates avalanche chutes. Its range is from southern Alaska to New Mexico (Elias 1980, Uchytil 1989).

Propagation:

Seed: Douglas maple begins to produce seed as early as 10 years of age. Douglas maple seeds reach maturity from August through early-October. Hand picking of the samaras is the best method of collection. Cleaning can be done by hand rubbing or hammermilling of the wings and blowing off chaff. Seeds should be dried to 10-15% moisture content and stored at 2-5%C in sealed containers. Pretreatment of 180-day warm stratification followed by 180-day cold stratification gives a 25% germination rate in container seeding in a greenhouse. Seed can also be sown by direct field planting in the fall (USDA 1974).

Seeds per pound: ~13,400 (Uchytil 1989)

Vegetative: Douglas maple sprouts easily from root crowns following a disturbance (USDA 1974).

References:

Elias, T.S. 1980. The Complete Trees of North America Field Guide and Natural History. Van Nostrand Reinhold Company, New York. 948 p.

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Acer macrophyllum
Bigleaf maple

Description:

Bigleaf maple is a long-lived, large deciduous tree reaching 30 m in height, with a broad crown. The bark becomes furrowed with small plates, and is gray to reddish-brown in color. The leaves are 15-30 cm in length and width, and have 5 deep lobes, pointed at the tips and heart-shaped at the base, with few blunt irregular teeth along the margin. The flowers are greenish-yellow and hang in elongated clusters at the end of the twigs. The fruit is a winged samara at an angle of 60% or less. The seeds are eaten by squirrels, chipmunks, mice, and many birds, while the saplings, young twigs, and leaves are eaten by blacktail deer, mule deer, and elk. Several species of perching birds use bigleaf maples as nesting sites. Bigleaf maple is an important source of hardwood lumber. The wood is hard, but not very strong, and is used for furniture, paneling, cabinets, veneer, and musical instruments. Although not produced commercially, maple syrup can be made from the sap. It is also a good tree to plant along streambanks for erosion prevention and as a soil binder (Elias 1980, Uchytil 1989).

Habitat and Geographic Range:

Bigleaf maple grows from sea level to 2000 m in elevation and can be found growing in a variety of soils from deep and loamy to shallow and rocky, although it attains its best development on deep alluvial soils near streams. It is extremely flood tolerant and often remains in floodplain habitats. Its range is from southwestern British Columbia to southern California and is usually found in association with Douglas-fir, western hemlock, and vine maple, but can form pure stands. Bigleaf maple's shade tolerance is low to moderate and grows most rapidly in small forest openings and open areas. (Elias 1980, Uchytil 1989).

Propagation:

Seed: Flowers are first produced at about 10 years of age. Trees growing in open habitats produce seed at an earlier age and produce larger quantities than trees growing in shade. Seed production of bigleaf maple is often heavy. Fruit ripens during the months of September and October and is dispersed from October through January. Seed tends to decay rapidly and cannot be stored even for short periods at cold temperatures. Seeds should be cold stratified at 1-5% C for 40-60 days. Buis (1996) suggests stratifying over winter in a refrigerator and sowing in February or early-March but has also noted excellent germination by sowing directly in the fall. Seed can be sown in mulched beds and should grow for 2 years before transplanting or outplanting (USDA 1974, Uchytil 1989, Haeussler at al. 1990).

Seed per pound: ~3250 (USDA 1974)

Vegetative: Bigleaf maple sprouts vigorously from the root crown after it is top-killed

or cut (Uchytil 1989). Small seedlings, with about 2-3 leaves, can be salvaged from construction sites and transplanted into containers (Buis 1996).

References:

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Elias, T.S. 1980. The Complete Trees of North America Field Guide and Natural History. Van Nostrand Reinhold Company, New York. 948 p.

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USDA Forest Service. 1974. Seeds of Woody Plants in the United States. USDA, Agric. Handb. 450. 883 p.

Alnus incana
THINLEAF ALDER (MOUNTAIN ALDER)

DESCRIPTION:

Thinleaf alder is a deciduous, shade-tolerant, multistemmed shrub or small tree which tends to form thickets and typically grows 2-5 m tall, but can reach heights of up to 15m. The bark is thin, smooth, and grayish. The leaves are broadly elliptic or ovate-oblong, 3-7 cm long, dull green, with doubly dentate margins. The male catkins are 3-10cm long and are clustered at the end of a twig. The female catkins are 9-13 mm long, semiwoody, conelike, and are on short stout stalks in clusters of 3-9. The fruit is a small, single-seeded nutlet, with narrow lateral wings and are borne in cones which remain on the plant for about a year after seeds are shed. Thinleaf alder is a nitrogen-fixer and has a high flood tolerance and thus improves soil fertility and stabilizes streambanks. The twigs and leaves of younger thinleaf alder plants are eaten by deer, elk, moose, muskrats, cottontails, and snowshoe hares. Beavers eat the bark and build dams and lodges with the stems. Alder seeds, buds, and catkins are eaten by many birds and are considered to be an important winter food source (Uchytil 1989, Haeussler et al. 1990).

HABITAT AND GEOGRAPHIC RANGE:

Thinleaf alder is the most widely distributed alder in western North America and is the most common alder of the Rocky Mountains, the Sierra Nevada, and the east side of the Cascades. It is found on a wide variety of sites, from near sea level to 3000 m. Thinleaf alder is found from central Alaska and the Yukon Territory, southeast to western Saskatchewan and British Columbia, and south to New Mexico and California. Thinleaf alder seldom grows away from water and is typically found near streams, rivers, or springs of moist mountain slopes on poorly developed soils of cobbles, gravels, or sands which remain moist year round due to high water tables (Uchytil 1989).

PROPAGATION:

Seed: Thinleaf alder produces abundant seed which is dispersed during fall and winter. However, seed viability can be quite low (Uchytil 1989). A seed crop is produced every 1-4 years. The fruit ripens from September to November and should be collected when the bracts start to seperate. They will fully open on a drying rack in a well-ventilated room if left for several weeks at ambient air temperature. Fresh seeds will germinate without stratification. Seed can remain viable in storage for up to 10 years when stored in sealed containers 1-3%C. Dried seed must be stratified for 180 days at 5%C. Spring sowing works best and outplanting is usually done with 1-0 stock (USDA 1974).

Seeds per pound: ~675,000 (Uchytil 1989).

Vegetative: Exposed thinleaf alder roots in streams will sprout and submerged branches sometimes form adventitious roots. Like other alders, thinleaf alder can sprout from the root collar or stump if damaged (Uchytil 1989, Haeussler et al. 1990).

References:

Haeussler, S., D. Coates, and J. Mather. 1990. Autecology of common plants in British Columbia: A literature review. British Columbia Ministry of Forests. FRDA Report-158. 272 p.

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USDA Forest Service. 1974. Seeds of Woody Plants in the United States. USDA, Agric. Handb. 450. 883 p.

Alnus rubra
Red alder

Description:

Red alder is a deciduous tree growing up to 35 m in height. The leaves are alternate, 7.5-13 cm long, ovate shaped, with a double serrated margin. The bark is smooth and bluish-gray in color. The male and female catkins appear separately on the same tree. Flowers are produced in the late summer and are borne in clusters of catkins. The male catkins are thin and 10-15 cm long while the female catkins are thicker and shorter, 0.8-1.2 cm long. The seeds are tiny winged nutlets found inside woody cone-like fruits called strobiles. The strobiles are 1.3-2.5 cm long, cylindrical shaped, persistent, and turn from green or yellow to brown as they ripen. Red alder is one of the first species to appear after wildfires, logging, and other disturbances. Red alder is a good nitrogen-fixer. It is not a significant wildlife tree although its leaves and twigs are browsed by deer and elk. Red alder is an important hardwood in the Pacific Northwest, used mostly for furniture and veneers (Harlow et al. 1979, Elias 1980, Jensen et al. 1995).

Habitat and Geographic Range:

Red alder grows in moist, rich, loamy soils, particularly in bottomlands and along streams. It is a lowland tree rarely growing above 1000 m in elevation and is usually found within 80 km of saltwater. Its range is from southern Alaska to northern California. It can be found in pure stands but is more commonly found with Douglas fir, Sitka spruce, western red cedar, western hemlock, Oregon ash, black cottonwood, bigleaf and vine maples, and Pacific dogwood (Elias 1980).

Propagation:

Seed: Red alder seed ripens between early-September and mid-October, depending on geographic location. Seed maturity can be checked by twisting a strobile along the long axis. If mature, the strobile should twist easily and the scales should part slightly. Strobiles can be collected by stripping from the branches with a cone rake and any leaf litter can be blown out with a fan. Strobiles found on the upper third of the tree usually contain the most viable seed. Once picked, the strobiles should be dried immediately using good air circulation to prevent molding. Strobiles can be dried on screens or in mesh bags at 16-27%C. Seeds are extracted by tumbling and cleaned by passing them through a screen. Small material can be removed by processing the seed with an air column. Once cleaned, seed can be stored for a short time by refrigeration. For long-term storage, seed should be dried to less than 10% moisture content and freezer-stored in moisture-proof containers at -12 to -13%C. Seed can be stored for up to 5 years without large losses in viability. No stratification is required for red alder seed. The best time to sow seeds is in spring. Due to their size, seeds should not be covered or they will not germinate. Red alder seeds also require plenty of water and a low nitrogen, high phosphorous fertilizer for germination and growth (Hibbs and Ager 1989, Jebb 1995).

Vegetative: Red alder softwood cuttings are best if taken from shoots of young trees, less than seven years in age or from epicormic sprouts of older trees. Cuttings should be 6-12 cm long and 2-4 mm in diameter. A chemical treatment of 2000-4000 ppm IBA solution increases rooting. Cuttings can be planted 2-4 cm deep into a moist perlite and vermiculite (1:1) media and maintained at 25%C until rooted. Once rooted, the cuttings should be transplanted to a vermiculite, perlite, and sandy loam mixture (1:1:1) and kept in a greenhouse for approximately five weeks with day and night temperatures of 21%C and 15%C, respectively. They can then be moved to a growth chamber and allowed to harden off. Cuttings can then be stored in a cold room during the winter and outplanted in the spring (Radwan et al. 1989).

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Jebb, T. 1995. Horticulturalist, USDI Bureau of Land Management. C.A. Sprague Seed Orchard. Merlin, OR. Personal communication.

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Radwan, M.A., T.A. Max, and D.W. Johnson. 1989. Softwood cuttings for propagation of red alder. New Forests 3:21-30.

Alnus sinuata (viridis spp. sinuata)
Sitka alder

Description:

Sitka alder is a deciduous shrub or small tree that grows about 10 m in height. The trunk rarely reaches more than 25 cm in diameter, and often grows crooked. The leaves are alternate, 7-14 cm long and 3-10 cm wide. Margins are doubly-serrated. Female catkins, 0.7-1 cm long, are found in long clusters on long stalks. Male catkins are 10-14 cm long and are found hanging at the end of the branch. The fruit is a small, single-seeded nutlet with wide lateral wings. Sitka alder is browsed by deer and the seeds are eaten by small birds. Sitka alder is too small for lumber, but the wood is used for smoking fish and as firewood. Due to its nitrogen-fixing ability, it improves soil fertility. Sitka alder is one of the first trees present after disturbances such as logging, fire, and landslides. It also helps to prevent soil erosion (Elias 1980).

Habitat and Geographic Range:

Sitka alder is a fast growing tree that grows from sea level up to 1200 m in elevation. It grows in rocky or gravelly soils, and can be found along streams, rivers, swamps, and in marshy flats. It ranges from southern Alaska south to northern California and into northern Idaho and Montana (Elias 1980).

Propagation:

Seed: Sitka alder begin producing seed at 4-7 years of age. Seed is dispersed during the fall and require a cold moist stratification of 1-3 months at 3%C. Dusting with a fungicide will help prevent mold but can reduce final germination percentage. Plants grow best in mineral soil with regular water and full sunlight (Uchytil 1989, Darris et al. 1994).

Vegetative: Sitka alder plants can sprout from the root collar or stump when damaged. Propagation by stem cuttings of Sitka alder is generally not very successful (Uchytil 1989).

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Darris, D.C., T.R. Flessner, and J.D.C. Trindle. Corvallis Plant Materials Center Technical Report: Plant Materials for Streambank Stabilization, 1980-1992. USDA Natural Resources Conservation Service, Portland, OR. 172 p.

Elias, T.S. 1980. The Complete Trees of North America Field Guide and Natural History. Van Nostrand Reinhold Company, New York. 948 p.

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Anaphalis margaritacea
Pearly everlasting

Description:

Pearly everlasting is an herbaceous perennial with many erect leafy stems up to 60 cm tall. The leaves are broadly to narrowly lance-shaped, 5-15 cm long, alternate, stalkless, and white wooly when young, the upper surface greening with age. The inflorescence is a terminal corymb composed of numerous small, white flower heads. The bracts surrounding the flower head are involucre, papery, and persist indefinitely. The center of each head is yellow and composed of disk flowers with the ray flowers absent. Male and female flowers grow on different flower heads. The seed is a minute, oblong achene with a tuft of fine bristles found only on the female plant (Peck 1961, Kruckeberg 1982, USDA 1988).

Habitat and Geographic Range:

Pearly everlasting ranges from Newfoundland south to North Carolina, Kansas, west to California, and up into Alaska. It grows in open sunny sites, shaded hillsides, semi-dry slopes, banks of streams, mountain meadows, and basins from lowlands up into subalpine regions. It can also be found in burned-over and cut-over areas growing in dense stands (Kruckeberg 1982, USDA 1988).

Propagation:

Seed: Seed matures from July to September and can be collected by hand. Seed can be cleaned with a hammermill and dried by clipping heads and laying them out on tarps or in bags. There is no available data on storage requirements. Seed can be sown directly or in containers in the spring and should be planted very shallow (Wright 1975, Link 1993).

Seeds per pound: ~8,000,000-11,000,000 (Link 1993).

Vegetative: Plants can be dug up, divided, and replanted when the clumps have become too dense, usually after three or four years of flowering. The best time of year for division is in the spring or fall (Wright 1975, Time Life, Inc. 1996).

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Kruckeberg, A.R. 1982. Gardening with native plants of the Pacific Northwest. University of Washington Press. 252p.

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Peck, M.E. 1961. A Manual of the Higher Plants of Oregon. Binfords & Mort Publishers, Portland, OR. 936 p.

Time Life, Inc. [Monograph Online]. Electronic Encyclopedia. Virtual Garden. http://pathfinder.com/@@yJuDF4F68wAAQAJ6/cgi-bin/VG/vg. Accessed June 26, 1996.

USDA Forest Service. 1988. Range Plant Handbook. Dover Publications, Inc. New York. 816 p.

Wright, R.C.M. 1975. The Complete Handbook of Plant Propagation. Macmillan Publishing Co., Inc. New York, NY. 191 p.

Asarum caudatum
Wild ginger

Description:

Wild ginger is a low growing, trailing, perennial, evergreen herb that reaches 15-25 cm in height. The alternate, simple leaves are heart-shaped, 5-15 cm across, prominently veined, aromatic, borne two per node, with long hairy petioles and entire margins. The flowers usually bloom near the ground and are often hidden by the leaves. They have three brownish-maroon broad sepals that form a cup around the ovary and taper to long pointed tails. The fruit is a large capsule containing small, angled or compressed seed (Zimmerman and Griffith 1991, Strickler 1993, Time Life, Inc. 1996).

Habitat and Geographic Range:

Wild ginger grows in moist, shaded woods below 1500 m and grows best in highly organic, slightly acidic soil. It ranges from British Columbia south to central California and is most commonly found from the Pacific Coast east to the Cascades. It can be found east of the Cascades, but occurs less freqently, and is also found in areas of northern Idaho and western Montana (Zimmerman and Griffith 1991, Strickler 1993).

Propagation:

Seed: Wild ginger flowers from April through July, depending on latitude and elevation (Zimmerman and Griffith 1991). The mature seed are difficult to collect but wild ginger seeds itself readily (Time Life, Inc. 1996).

Vegetative: Wild ginger has an extensive rhizome system. New plants can be made from divisions taken in early spring or fall when the parent plant is dormant. The rhizomes should be planted 1 cm deep with the tip of the rhizome reaching the soil level. Plants should be spaced 30 cm apart and the soil should be kept moist with a mulch of oak or beech leaves (Zimmerman and Griffith 1991, Time Life, Inc. 1996). Root cuttings can be taken in the summer and started in sand for fall planting (Time Life, Inc. 1996).

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Betula papyrifera
PAPER BIRCH

DESCRIPTION:

Paper birch is a medium size deciduous tree that grows up to 25 m tall with a rounded crown. The distinctive bark is cream-white with small, dark, horizontal lenticels and peels readily in sheets. The leaves are alternate, triangular to ovate shaped, pointed at the tip, and serrated along the margin except close to the base of the leaf. The male and female flowers occur as separate catkins on the same tree and are found near the tips of the branchlets. The male catkins are 7-10 cm long while the female catkins are 2.5-3 cm long. The fruits are a drooping catkin-like strobile consisting of an abundance of scales, which enclose a tiny winged seed. The twigs are a food source for moose and deer, and beaver feed on the inner bark. The seeds are eaten by small birds and rodents. The wood is strong and hard and is used for veneer and pulpwood. The bark is used for birchbark canoes, and the sap can be boiled down for syrup (Elias 1980).

HABITAT AND GEOGRAPHIC RANGE:

Paper birch mainly occurs at moderate elevations in a wide range of soil and moisture conditions but prefers a well-drained sandy loam soil. It may form pure stands on wet sites. It ranges across Canada southward into the northern United States. It is a pioneer tree after fire disturbance and is commonly associated with white and black spruce and poplar (Elias 1980).

PROPAGATION:

Seed: Paper birch is a prolific seed producer. Seed production begins at about age 15, with optimum production at 40 to 70 years of age. Good seed crops are produced every second to third year. Nearly all the seed (about 90 to 95 percent) is shed from September through November. Discolored and empty seeds make up 14 to 47 percent of a crop. Seed viability is highest during heavy seed crop years and lowest during light seed crop years. Seeds are collected by picking or stripping the strobiles while they are still green enough to hold together and placing them directly into bags. Strobiles should be spread out to dry until disintegration begins. They can be shattered by flailing and shaking and seeds can be separated by screening and fanning. Seeds can be stored with a 1-5% moisture content at room temperature for 1.5-2 years. Unstratified seed germinates better than stratified seed. Seed is usually sown during late-summer or fall, but spring sowing can be done after 4-8 weeks of cold stratification. First year seedlings are 5-12 cm tall. Seedlings require moderate shade during the first summer and can be outplanted after 1 or 2 years (USDA 1974, Uchytil 1991).

Vegetative: Paper birch sprouts following cutting or fire. Sprouts typically arise from the stump base or root collar. Prolific sprouting is common in young trees, with some individuals producing up to 100 sprouts. Sprout growth is rapid, sometimes up to 24 inches (60 cm) in the first growing season (Uchytil 1991). Timing is critical when taking

birch cuttings. Cuttings should be taken when shoots are still active with the base of the cutting just becoming firm. If the terminal bud is visible, results are usually poor. Nodal cuttings 15-20 cm long with a long shallow wound are best. Cuttings should be dipped in an 8000 ppm IBA-talc rooting hormone before planting in a peat:sand medium. If cuttings root early, they can be transplanted into pots, otherwise they should not be disturbed. Growth can be accelerated for both seedlings and cuttings by placing them under long, warm day conditions with good air circulation and adequate moisture and nutrition (Dirr and Heuser 1987).

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Carex obnupta
Slough sedge

Description:

Slough sedge is a somewhat clustered, erect, evergreen perennial growing 60-150 cm tall. The culms are rather stout, triangular in cross section, and bear 3-7 pendulate floral spikes 1.5-5 cm long. The leaves are mostly basal, flat, deep green, 2-6 mm wide and up to 3 dm long, the margins are rolled under with an obvious channel running along the leaf's axis. The upper 1-3 spikes of the inflorescence are male and often curving. The lower 2-4 spikes are cylindrical and female, or may have male flowers at the top. They are found on short erect stalks or are occasionally stalkless. The perigynia is shiny, yellowish-green or brown in color, elliptical, plump, leathery and thick-walled. It is two-ribbed but nerveless on both sides with a very short beak. The scales are purplish-black, with sharp tips, and are longer than the perigynia (Peck 1961, Weinmann et al. 1984, Pojar and MacKinnon 1994)

Habitat and Geographic Range:

Slough sedge is found in shallow fresh marshes and swamps. It can also be found in bogs, stream-banks, coastal shores, and wet forest openings. It is common at low elevations and ranges from British Columbia south to California west of the Cascade Mountains (Peck 1961, Pojar and MacKinnon 1994).

Propagation:

Seed: Seed can be collected by hand in June and July. It requires little to no cleaning. It can be stored dry in a refrigerator in a ziplock bag and opened once every few months to air out. Before planting seed should be spread out damp in a refrigerator during August. Seed can be sown in February in a regular potting soil and placed into a hoop house. Germination usually occurs within a month (Buis 1996).

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Carex rostrata
Beaked sedge

Description:

Beaked sedge is a large, grasslike perennial that grows in tufts from short root stocks. The culms are stout, 40-120 cm high, sharp-angled only above, and usually much shorter than the leaves. The leaves are nodulose, flat, 5-12 mm wide, with soft and spongy sheaths. There are 4 to 10 leaves per stem. The bracts are leaf-like, very long and usually surpassing the inflorescence. Beaked sedge has two types of spikes: a terminal, relatively small staminate, and a lower, axillary, larger pistillate. The seed, which is an achene, is often three-angled and enclosed in a saclike body called the perigynium. The perigynia is ovoid, 4-6 mm long, inflated, strongly nerved, straw-colored or brownish, abruptly narrowed to a cylindric, with a strongly bidentate beak and a third to a fourth as long as the body. Beaked sedge stands are important feeding and breeding grounds for geese and waterfowl and the plants is often grazed by elk, moose, and reindeer (Peck 1961, USDA 1988, Cope 1992).

Habitat and Geographic Range:

Beaked sedge is very common in wet meadows, marshes, and on edges of lakes, ponds, streams, and other riparian areas. Soils may have large amounts of peat but it also grows on sandy, silty, clayey, loamy, alluvial, or granitic soils. It is found in a cool and semi-arid climate at elevations of 750-3350 m. It ranges from Greenland to Alaska, southward to Arizona, and east to Kansas and Delaware (Cope 1992).

Propagation:

Seed: The shoots of beaked sedge emerge during July and August. The flora primordia develop in August and September and the shoot flowers during June and July of the following year. The shoots that flower usually die in late-August or September (Cope 1992). The achenes can be harvested during August and September by clipping the inflorescence from the plant. The perigynia can be pressed between the thumb and index finger to test for the presence of an achene inside. The inflorescences can be dried by spreading them out over a fine screen in a warm, dry, well-ventilated area. Seed can be cleaned by hand-stripping, and using a sieve or air-screen cleaner to remove chaff. Purity can by improved with a seed blower. Seed can be stored in sealed containers at room temperature with a moisture content of 6-8% for up to 17 months (Hurd and Shaw 1992). Seed should be spread out damp in a refrigerator before planting. Seeds can be sown in February in regular potting soil and placed in a hoop house. Germination usually occurs within a month (Buis 1996)

Vegetative: Beaked sedge reproduces by rhizomes that range from 1 cm to 2.5 m in length. A long rhizome first emerges and produces a shoot, then short rhizomes develop to produce a tuft of many shoots. These give the plant a matted and tufted growth pattern. When shoots first develop, they do not have any roots. Beaked sedge can also reproduce by stolons (Cope 1992).

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Ceanothus sanguineus
Redstem ceanothus

Description:

Redstem ceanothus is a shade-intolerant deciduous erect shrub growing 1-3 m in height. The stems are greenish when young and darken to a purplish-red as they mature. The leaves are alternate, 2.5-9 cm long, thin, oval to elliptical in shape, dark green and glabrous above, paler below, 3-veined, with serrate margins. The flowers are small, cream to white in color and borne in a panicle. The fruits are three-celled capsules, with a single seed in each cell. Redstem ceanothus is a food source for elk, deer, hares, birds, rodents, and many insects. It also provides cover for many mammals and birds. Due to its deep root system and nitrogen-fixing ability, it is an excellent pioneer shrub for soil stabilization and improving soil fertility (Randall et al. 1978, Tirmenstein 1990).

Habitat and Geographic Range:

Redstem ceanothus ranges from southern British Columbia to the Siskiyou Mountains in northern California, east to Idaho and western Montana. It grows best on moist well-drained soils that are low in organics. It can be found at low- to mid-elevations in the open or partial shade (Randall et al. 1978, Tirmenstein 1990).

Propagation:

Seed: Sprouts of most species can produce at least some seed by 3 to 6 years of age. The seed of redstem ceanothus is approximately 2 mm in length, with a hard, impermeable seedcoat and dormant embryo. Most species of ceanothus are prolific seed producers, although some annual variation has been noted (Tirmenstein 1990). Redstem ceanothus produces fruit during June and July. Ripening is usually in August and appears to be associated with moisture stress.. Seed should be collected just as the first capsules break open. Viable seed will turn dark brown as they mature, insect infested seed or unfilled seed will be lighter in color. Capsules can be collected by hand and should be gently cracked and broken to prevent damage to the seed. Most of the cracked capsules will open if stored in dry covered containers for several days at 21-27%C. The seed can then be extracted with a seed cleaner. Seed can be stored in dry paper containers at 3%C and do not appear to lose much viability over long periods of time. Seed should be soaked in 80-90%C water or dipped in boiling water for 10 seconds to 5 minutes followed by a cold stratification for 90 days. Soaking seed in sulfuric acid for 30 minutes or dipping them in gibberellin will help improve germination. Seed can be sown directly in the fall after heat treatment or pre-treated and sown in spring (Gratkowski 1973, Tirmenstein 1990).

Seeds per pound: ~130,000 (Tirmenstein 1990)

Vegetative: Redstem ceanothus often sprouts after the crown is damaged or destroyed (Tirmenstein 1990). No information is available at this time regarding artificial vegetative propagation.

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Chimaphila umbellata
Prince's pine

Description:

Prince's pine is a small, erect perennial herb that grows 10-30 cm tall. The leaves are whorled, oblanceolate, with sharply serrated margins, and 3-7 cm long. The pinkish flowers are borne 3-15 in a terminal cluster. Each flower has 5 rounded petals. The fruit is a 5-celled capsule, 7 mm across, containing numerous, minute seeds and persisting through winter. In some parts of its range Prince's pine is browsed by deer and elk during the winter. The leaves are used in making root beer (Helliwell 1987, Matthews 1994, Time Life, Inc. 1996).

Habitat and Geographic Range:

Prince's pine is ranges from Newfoundland to Alaska south to California and Mexico, east to New Mexico, Colorado, and South Dakota. In the eastern United States it ranges from Maine south to Georgia and west to Minnesota. Its elevational range is from 300-3500 m. It grows on a variety of soils but is most commonly found on dry, well-drained, rocky, sandy, acidic soils. Prince's pine is a moderately shade-tolerant species and is frequently found growing in old-growth and climax forests of the Pacific Northwest (Matthews 1994).

Propagation:

Seed: Prince's pine flowers from June to August (Matthews 1994)

Vegetative: Stem cuttings can be taken during the summer and rooted in a sand and peat moss medium. Rooted cuttings can be outplanted in late spring with a 15-20 cm spacing (Time Life, Inc. 1996). Prince's pine produces long, fast-growing rhizomes. Those that are near the soil surface are able to produce new shoots (Matthews 1994). Prince's pine can be propagated by division of underground stems (Time Life, Inc. 1996).

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Chrysolepis (Castanopsis) chrysophylla
GOLDEN CHINKAPIN

DESCRIPTION:

Golden chinkapin is a medium to large tree that grows 15-40 m in height with a broad, rounded crown. The leaves are evergreen, alternate, lanceolate, 5-15 cm long, with entire but slightly wavy margins. The leaf texture is leathery and the underside is covered with golden-colored hairs. The bark is a thick, dark reddish-brown with deep fissures dividing the broad rounded ridges. The male catkins are 5-6.5 cm long and are produced at or near the tips of the branchlets. The female catkins are short and found clustered at the base of the stalks bearing the male flowers. The fruit is a nut that matures in two seasons and is enclosed in a spiny bur growing on the previous year's branchlets. The nuts are eaten by bears, deer, small mammals and rodents, and some birds. The wood is soft, brittle, and fine-grained and is used mainly for wood heating and campfires (Elias 1980).

HABITAT AND GEOGRAPHIC RANGE:

Golden chinkapin grows in the mountain slopes of the Pacific Coast region from 1000-2000 m and ranges from western Washington south into central California. It is found in valleys and sheltered ravines. Soil conditions range from dry rocky soils to deep rich soils. Golden chinkapin grows in association with western juniper, canyon oak, and scrub oak (Elias 1980).

PROPAGATION:

Seed: The fruit ripens during August and September. The burs should be hand-picked in late-summer or early-fall, after ripening but before they open. The burs should be spread out to dry in a warm room and run through a fruit disintegrator or shaker to separate the nuts. The nuts can be stored in sealed containers at 5%C and will retain their viability for 2-5 years. Seeds do not need to be cold stratified and can be planted directly into containers larger than 10 cm^3 and covered with 5 cm of soil (Jebb 1995). Survival after emergence can be problematic (USDA 1974).

Vegetative: Golden chinkapin regenerates vegetatively from adventitious buds found on stumps or basal burls (McMurray 1989). Propagation by cuttings is difficult, even with mist and a rooting hormone. Layering, grafting, and budding have been shown to be effective means of propagation (Kruckeberg 1982).

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Cornus canadensis
Bunchberry

Description:

Bunchberry is a low growing perennial herb reaching only 5-20 cm in height. The leaves are alternate but appear as if growing in two whorls. The leaves are up to 8.5 cm in length, 5 cm in width, lanceolate to ovate in shape, and have lateral veins that are nearly parallel with the margin. The small white flowers are borne in dense heads, with 4 toothed sepals, 4 reflexed petals, 4 stamens, and a somewhat flattened stigma making the entire inflorescence resemble a single flower. The fruit is a small red drupe with a small stone often containing a single seed. The seeds of bunchberry are much smaller than those of other dogwoods (Hall and Sibley 1976, Helliwell 1987).

Habitat and Geographic Range:

Bunchberry grows in cold, boglike soils that are rich in sphagnum moss and slightly acidic. It prefers moist, shaded woods at moderate to high elevations and can be found ranging from Alaska to Greenland, and extending into the mountains of California in the west, and down in to the mountains of West Virginia in the east (Helliwell 1987, Time Life, Inc 1996).

Propagation:

Seed: The fruit ripens in August and is collected by shaking or stripping from the branches. The seeds can be cleaned and separated by macerating in water, and floating off the pulp. Seed germinate best when sown right after cleaning in the fall. They should be planted 0.6-1.3 cm deep in a 3:1, sand:sphagnum moss media and covered with a layer of sawdust or pine needle mulch over winter. Seed can be stored in sealed containers at 3-5%C for 2-4 years. Stratification of the seed is for 30-60 days at 25%C followed by 120-150 days at 0.5%C. Seeds may take up to 3 years to germinate The establishment of new bunchberry plants from seed is low due to low fruit set, low germination and survival rates, and slow early growth (USDA 1974, Crane 1989, Time Life, Inc. 1996).

Seeds per pound: ~67,000 (USDA 1974).

Vegetative: Although some new seedlings are established by seed, bunchberry is a clonal perennial that relies heavily on vegetative regeneration to maintain itself and spread. It responds vigorously to disturbance (Crane 1989). Bunchberry grows laterally in organic matter by rhizomes with several dormant buds. Clumps can be transplanted but better establishment is achieved with well-grown seedlings set out in pots (Kruckeberg 1982).

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USDA Forest Service. 1974. Seeds of Woody Plants in the United States. USDA, Agric. Handb. 450. 883 p.

Cornus nuttallii
Pacific dogwood

Description:

Pacific dogwood is a small deciduous tree that can obtain heights up to 30 m, but usually grows no more than 9-12 m. The bark is reddish-brown and smooth or can have thin plates near the base. The leaves are opposite, simple, ovate to obovate in shape, arcunate veins, and wavy-toothed along the margins. The flowers are produced in dense heads with 4-6 white petal-like bracts. The fruit is a bright red drupe produced in dense rounded heads of 30-40. It is a popular ornamental. The fruit is a main staple of black bears and many birds. Beavers eat the fruits, wood and leaves, while deer browse the twigs and leaves. The wood is extremely hard and fine grained and is used in making cabinets and tool handles. Pacific dogwood has a high flood resistance and is therefore effective in streambank stabilization with areas containing deep and well-drained soils. Douglas-fir regeneration can be slowed by the water soluble leachates from senescent leaves of the Pacific dogwood (Randall et al. 1978, Elias 1980, Griffith 1992).

Habitat and Geographic Range:

Pacific dogwood is found in bottomlands, moist river soils, and along stream banks from near sea level to 1820 m in elevation. It prefers deep, well-drained soils high in nitrogen with a rich humus layer. It ranges from southwestern British Columbia south on the west of the Cascade and Sierra Nevada Mountains into southern California (Randall et al. 1978, Elias 1980, Griffith 1992).

Propagation:

Seed: Pacific dogwood reaches sexual maturity at 6 to 10 years of age. Large seed crops are produced at two-year intervals. Seed maturity and dispersal occur from September to October and can be collected by shaking or stripping the branches. Seed can be sown directly in the fall without removing them from the fruit, or cleaned for storage by macerating in water and allowing the pulp to float off. Seeds can be stored in sealed containers at 3-5%C for 2-4 years. Stored seeds should be scarified in concentrated sulfuric acid (H_2SO_4) for four hours, rinsed, then stratified at 3%C for 90 days and sown in the fall. Seed beds should be covered with up to 1.3 cm of soil and mulched with sawdust over winter (USDA 1974, Griffith 1992).

Seeds per pound: ~4700 (USDA 1974)

Vegetative: Pacific dogwood resprouts from the root crown after disturbance by fire or logging. Cuttings can be taken in June and July and treated with a rooting hormone. They should be cultivated in clay pots to help retain water and prevent root rot. Cuttings should be kept for no more than two years since transplants after this time have a high mortality rate. When transplanting, Pacific dogwood should be placed in a ring of native shrubs to protect the lower trunk and branches from sunburn (Griffith 1992).

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Cornus stolonifera (Cornus sericea)
Red-osier dogwood

Description:

Red-osier dogwood is a deciduous many-stemmed shrub that grows 2-5 m tall. The stems are branched oppositely and bear a smooth purple to bright-red color, especially during dormancy. The leaves are 7-12 cm long, elliptic to ovate shaped with distinct, curving veins. The small white flowers are found in a flat-topped cyme and produce a white or bluish drupe. The red-osier dogwood is a favorable winter browse and forage for a variety of wildlife. The fruit is eaten by many different birds, and the twigs and foliage are browsed by whitetail deer, mule deer, snowshoe hare, moose, and elk (Elias 1980, Haeussler et al. 1990, King County 1994).

Habitat and Geographic Range:

Red-osier dogwood has a wide range and an ability to tolerate extremely cold temperatures. It can be found at elevations of 450-2700 m from central Alaska to Newfoundland south to California, and east to Nebraska and New York. Red-osier dogwood is a characteristic species of swamps, low meadows, and riparian zones; it is also found in forest openings, open forest understories, and along forest margins. It prefers wet sites and is usually found along streams in association with alders and willows (Elias 1980, Crane 1989).

Propagation:

Seed: Plants first bear fruit at 3 to 4 years of age although the older plants are more prolific (Crane 1989). The best time to collect the fruit is in August and September. This can be done easily by stripping or shaking the branches. The drupes can be planted immediately into flats, or cleaned and processed for later sowing. The seed is removed by macerating in water or running through a hammermill and floating away the pulp. Dried seeds can be stored in sealed containers at 3-5%C for 2-4 years. Seed does best when sown in the fall and should be cold stratified at 3-5%C for 60-90 days prior to planting. Sometimes hard seed coats are present and scarification is necessary. Not all seeds will germinate right away. Seeds can be planted into gallon containers or nursery beds, covered with 0.5-1.5 cm of soil and mulched with 1.5-2.5 cm of sawdust (USDA 1974).

Vegetative: On good sites, red-osier dogwood can form dense thickets by layering when the lower stems touch the ground and root at the nodes (Crane 1989). Cuttings of 5 to 8 cm from the branch tips can be taken in late-summer, or whips of 0.5 to 1 m can be taken from one-year-old wood during November through March when the tree is dormant (King County 1994). A light strength rooting hormone can be used though it is probably not necessary. The cuttings should then be stuck in a perlite:vermiculite (1:1) mixture and set on a mist bench at 21%C. Once rooting has occurred, they can be transplanted into a regular potting soil and moved to a greenhouse (Buis 1996).

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Crataegus douglasii
Douglas Hawthorn

Description:

Douglas hawthorn is a shrub or small tree usually about 4 m in height. The stems typically grow clustered near the base of the tree or just above the soil. Lower shade-killed limbs remain on the stem, forming large, dense thickets. The branches bear thorns up to 2.5 cm long. The leaves are oval, 3-6 cm long, and are irregularly lobed or serrated. The flowers are white, 1.5 cm in diameter, and are produced in clusters of 5-12 during the spring. The fruit is a dark purple to black berry about 1 cm in diameter. Douglas hawthorn provides sufficient food and both thermal and hiding cover for many wildlife species. Birds also use the thickets for nesting and brooding cover, and it is the preferred nesting habitat for magpies. Douglas hawthorn is an excellent soil and streambank stabilizer but does not typically occupy disturbed sites (Elias 1980, Habeck 1991, Strickler 1993).

Habitat and Geographic Range:

Douglas hawthorn ranges from southeastern Alaska south to northern California, eastward to Colorado and western Montana. It can be found at lower elevations from 670-1645 m. It grows in wetland, riparian, or upland areas but can also be found on steep, uncultivated slopes and prefers deep, moist, fine-textured soils (Elias 1980, Habeck 1991).

Propagation:

Seed: Seed ripens from late-July through August and can be collected by gathering off the ground. Frequent cutting tests are necessary during fruit collection due to a variation in the number of sound seed among trees. Seeds should be extracted immediately either by macerating and floating off the pulp or by spreading them out in thin layers to avoid excess heating. Seeds should be thoroughly air dried before storing and can be kept for 2-3 years at 5%C. Black hawthorn requires acid scarification for 0.5 to 3.0 hours followed by a cold stratification of 5%C for 84-112 days. Seed will generally yield 50 to 80 percent germination. Seed should be sown early in the fall or kept in moist, cool storage after acid scarification in the winter, and sown the following spring. Sown seeds are covered with 0.5 cm of firm soil and should not remain in the seedbed for longer than one year due to development of a long taproot. Successful establishment of seedlings is difficult and growth rates are slow (USDA 1974, Habeck 1991).

Seeds per pound: ~22,600 (Habeck 1991)

Vegetative: Removal of aboveground stems will result in resprouts and suckers from the root system (Habeck 1991). Douglas hawthorn can be propagated by suckers and layering (Keator 1994).

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Dicentra formosa
Pacific Bleeding heart

Description:

Pacific bleeding heart is a herbaceous perennial growing 20-45 cm tall. The leaves are basal with long petioles, biternately compound, fleshy-textured, deeply cut, and smoothly glaucous. The pink to purple flowers are pendant, heart-shaped, with deeply saccate or spurred petals, and are found coupled on stems rising above the foliage. The fruit is a two-valved capsule containing shiny black seed (Schmidt 1980, Kruckeberg 1982).

Habitat and Geographic Range:

Pacific bleeding heart ranges from southern British Columbia south to central California, and is found mostly on the west side of the Cascade mountains. It grows at elevations up to 2100 m and prefers shady, moist, well-drained areas rich in organic matter (Schmidt 1980, Strickler 1993, Time Life, Inc. 1996).

Propagation:

Seed: Seed matures during August and early-September and is easily collected. Cleaning is done with a hammermill and low air flow. Seed should be sown fresh in late-summer or fall. Link (1993) had 0% germination with seeds that were stored cool and dry, and had gone through a 48-day cold-moist stratification period. Buis (1996) kept the seed in a refrigerator over winter and obtained a 50% germination with spring planting.

Vegetative: Pacific bleeding heart produces large rhizomes and is easily propagated by dividing the rhizomes after the plant has flowered (Time Life, Inc. 1996).

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Eriogonum nudum
Barestem buckwheat

Description:

Barestem buckwheat is a perennial with stems that are smooth and slender and grow up to 0.9 m tall. The basal leaves originate from a short woody crown. The leaves are slender stalked with dense, white woolly beneath turning nearly hairless on the upper surface. The flowers are usually white but occasionally tinted with rose or yellow, and are clustered on a repeatedly two- or three- forked inflorescence. The fruit is a hard dry achene that usually contains one seed (Dayton 1960, Schmidt 1980)

Habitat and Geographic Range:

Barestem buckwheat ranges from Washington south to California and Nevada. It prefers rocky, sandy, well-drained soils and usually grows in exposed, sunny, warm sites on dry hills, valley flats, and mountain slopes (Dayton 1960, USDA 1988).

Propagation:

Seed: Barestem buckwheat flowers during July and August. Seed will germinate without pretreatment. Seed should be planted in the fall in a coarse soil medium and covered with sphagnum moss to help prevent damping-off. The following spring, seedlings can be transplanted into three inch pots and allowed to grow until they are large enough for outplanting (Schmidt 1980).

References:

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Eriogonum umbellatum
Sulphur buckwheat

Description:

Sulphur buckwheat is an erect perennial with a tufted, woody crown and root. The leaves are basal or clustered at the ends of the branches and have dense white pubescence underneath. The flowers are sulphur yellow in color, hairless with the calyx narrowed into a long, stalk-like base. The involucres are long-stalked, with 8 bent-back lobes, in a simple umbel with a whorl of leaflike bracts at the base. The fruit is a hard, dry, usually one-seeded achene (Dayton 1960, Schmidt 1980, USDA 1988).

Habitat and Geographic Range:

Sulphur buckwheat grows on dry open sites in valleys and on mountain slopes from sea level up to subalpine elevations. It is found predominantly in dry areas and prefers rocky, sandy, and well-drained soils in places with moderate or low rainfall. It can be found from southern British Columbia south to California, and eastward to Colorado, Wyoming, and Montana (Dayton 1960, USDA 1988).

Propagation:

Seed: Sulphur buckwheat flowers from June to August. Seed requires no pretreatment and can be planted in the fall in a coarse soil medium and covered with sphagnum moss to help prevent damping-off. Seedlings can be transplanted into three inch pots the following spring and allowed to grow until they are large enough to outplant (Schmidt 1980).

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Fragaria vesca
WOODS STRAWBERRY

DESCRIPTION:

Woods strawberry is a perennial herb that grows up to 20 cm tall with long runners that creep along the ground. The yellowish-green oval leaves are palmately compound with 3 leaflets. The leaflets have coarsely serrated margins, long silky hairs on the surface, and are found at the end of a leafstalk. The flowers have 5 white petals, numerous yellow stamens, and grow on a separate shorter stalk than the leaves. The fruit is a red berry up to 2 cm long (Helliwell 1987, Snyder 1991)

HABITAT AND GEOGRAPHIC RANGE:

Woods strawberry grows on cut-over lands, roadside ditches, and open woodland and rocky places. It prefers moderately-drained sites and grows in full sun or light shade (Kruckeberg 1982, Govt. of Saskatchewan 1989, Snyder 1991).

PROPAGATION:

Seed: The fruit of Woods strawberry ripens by late-June. The seed can be cleaned by blending with water for 12 seconds and allowing to sit until the seed falls and the pulp floats to the top. Seed can be stored and will remain viable for up to 20 years. A 2-3 month cold treatment and exposure to light will increase gemination. Seed can be planted in flats indoors 6-8 weeks before the last frost or outdoors early in the spring and can take up to several months to germinate. Seedlings should be transplanted 6 weeks after germination, allowed to harden off, then set out in the field after 6 more weeks (Foster 1977, Time Life, Inc. 1996).

Vegetative: Newly rooted runners can be cut from the parent plant and transplanted in early spring. The crown should be planted even to the surface of the soil (Snyder 1991). Runners with at least two nodes can be cut from the plant during spring to mid-summer. The basal end should be treated with a mild strength rooting hormone and stuck into a growing medium of perlite:vermiculite (1:1). They can then be placed on a mist bench at 20%C. Once rooted, the plants can be transplanted into regular potting soil and placed in heavy shade in a greenhouse (Buis 1996).

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Fragaria virginiana
Broadpetal strawberry

Description:

Broadpetal strawberry is a low-growing perennial herb with long runners that creep along the ground. The bluish-green oval leaves are glaucous, glabrous, borne in 3's with coarsely serrated margins and are found at the end of a leafstalk. The flowers are in groups of 2-15 with 5 white petals, numerous yellow stamens, and grow on a separate shorter stalk than the leaves. The fruit is a red berry that is smaller and more conical than the cultivated strawberries (Helliwell 1987, Govt. of Saskatchewan 1989, Time Life, Inc. 1996)

Habitat and Geographic Range:

Broadpetal strawberry grows among grasses in open woods, fields and meadows. It does best in well to imperfectly drained humus-filled soils and is usually found at low to mid elevations, but occasionally grows at high elevations (Kruckeberg 1982, Helliwell 1987, Govt. of Saskatchewan 1989, Time Life, Inc. 1996).

Propagation:

Seed: The fruit ripens by late-June. The seed is cleaned by macerating for 12 seconds and allowing the pulp to float off. Seed can be stored and remain viable for up to 20 years. Germination is increased with a 2-3 month cold treatment and exposure to light. Seed can be planted in flats and may take several months to germinate. Seedlings should be transplanted 6 weeks after germination, allowed to harden off, then set out in the field after 6 more weeks (Foster 1977).

Vegetative: Newly rooted runners can be cut from the parent plant and transplanted in late-summer or early-fall. The crown should be kept above the surface of the soil (Foster 1977, Time Life, Inc. 1996).

References:

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Mahonia (Berberis) nervosa
OREGON-GRAPE

DESCRIPTION:

Oregon-grape, also called dwarf Oregon-grape or longleaf hollygrape, is a low growing, rhizomatous, evergreen shrub that reaches 80 cm in height. The stems are simple, ascending to erect and generally grow in loose groups of several stems. The leaves are pinnately compound and borne in terminal tufts with 7-21 dark green, glossy, leathery leaflets. The leaflets are ovate to lance-ovate or acute in shape with coarsely serrate to spinose margins. The yellow flowers are found on erect racemes that grow up to 21 cm long. The fruit is a large, dark blue, globose berry, 8-10 mm in diameter containing a number of black seeds. Oregon grape is browsed by black-tailed deer, the foliage is eaten by various small mammals, and the fruit are eaten by many small birds and mammals (USDA 1988, Tirmenstein 1990).

HABITAT AND GEOGRAPHIC RANGE:

Oregon-grape ranges from southern British Columbia south to central California and occurs west of the Cascade Ranges and the Sierra Nevada. It can be found at low to mid elevations. It grows on a variety of soils including coarse, shallow, rocky soils, coarse alluvium, or glacial outwash. Soils range from well-drained to poorly drained and habitats vary from submontane to montane forests. It is a shade tolerant species and can grow in the understory of 300-600 year old forests, but also grows in open meadows and recent clearcuts (Tirmenstein 1990).

PROPAGATION:

Seed: Oregon-grape flowers in early to late spring and fruit ripens during July and August. Fruit should be collected in August to September and can be picked by using heavy gloves or by flailing onto cloths or receptacles spread beneath the bushes. The berries can be cleaned by macerating with water and allowing the pulp to float off. The seed can be immediately sown in 1.25 cm of soil plus 0.6 cm of sand and stratified over winter, or dried and stored in sealed containers at temperatures just above freezing. Spring sown seeds should be cold stratified for 6 weeks at 4%C. Plants can be outplanted after 2 years (USDA 1974, Foster 1977).

Vegetative: Oregon-grape is rhizomatous and gradually expands laterally in the absence of disturbance. Plants generally sprout from rhizomes after aboveground portions of the plant are destroyed. Vegetative regeneration appears to be the dominant mode of regeneration after fire or other disturbances (Tirmenstein 1990). Oregon-grape can be propagated by taking heeled, nodal, and basal cuttings. Spines and leaves should be removed and the base should be treated with a rooting hormone. They can be stuck in a 2:1 vermiculite:sand mixture in a cold frame (Huxley et al. 1992). Buis (1996) does not recommend cuttings due to the bulkiness of the cutting and the struggle with getting them

to stay in the flats but has had moderate success with root cuttings on nursery stock or salvaged plants, though this method is destructive to the parent plant.

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Lupinus latifolius
Broadleaf lupine

Description:

Broadleaf lupine is a many-stemmed perennial herb that grows 0.5-1.5 m tall. The stems are erect with thinly appressed pubescence. The leaves are palmately compound with 7-9 oblanceolate shaped leaflets, 4-8 cm long, that are dark green above and whitish underneath. The flowers are dark blue to purplish in color, pea-type with an unspurred calyx, and borne in dense, long pyramidal racemes. The fruit is a dark, flattened, sparsely hairy pod, 2-3.5 cm long, containing several seeds (Gilkey and Dennis 1980, Helliwell 1987).

Habitat and Geographic Range:

Broadleaf lupine grows from lowland to subalpine elevations in the Cascade Mountains from British Columbia south to California, and west to the coast. It can be found in moist or open woods and along roadsides (Gilkey and Dennis 1980, Helliwell 1987, Link 1993).

Propagation:

Seed: Lupine seed matures from June to September. Seed should be collected by hand while the pods are still closed and put into cloth bags for drying. Seed should be cleaned with a hammermill and can be stored in a cool dry environment for several years. Seed should be pretreated by soaking in hot water for 1-16 hours then inoculating with *Rhizobium lupini* at the time of planting. Broadleaf lupine can be propagated by direct seeding or by growing plugs to transplant (Link 1993).

Seeds per pound: ~350,000 (Link 1993).

Vegetative: Cuttings can be taken from side shoots of hardened stems in the spring (Foster 1977).

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Foster, C.O. 1977. Plants-a-Plenty: How to Multiply Outdoor and Indoor Plants Through Cuttings, Crown and Root Divisions, Grafting, Layering, and Seeds. Rodale Press, Inc. Emmaus, PA. 328 p.

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Lupinus lepidus
Prairie lupine

Description:

Prairie lupine is a low, spreading, many-stemmed, decumbent perennial. There are brownish-yellow to silver appressed hairs over the whole plant. The floral stems reach 10-25 cm and grow among and above the leaves. The leaves are palmately compound with 5-7 oblanceolate leaflets that are 1-4 cm long. Most of the leaves are basal but some originate on the stems. The dark blue to purple, or sometimes white flowers are borne in dense spikes. The flowers are 8-13 mm long with the banner petals bent sharply backward and usually a different color from the wings and keels. The fruit is a flattened pod containing 2-12 seeds (Gilkey and Dennis 1980, Strickler 1993).

Habitat and Geographic Range:

Prairie lupine ranges from British Columbia south to California and east to Montana and Colorado. It grows in open prairies up into the mountains (Strickler 1993).

Propagation:

Seed: Plants bloom from June to August. Seed can be hand collected but collecting is slow due to the small plant size. Seed can be dried in the pods in paper bags, hand threshed, and screened to remove the pods and stem material. Air-dried seed can be stored under cool, dry conditions. Seed requires scarification and can be shaken in a jar half-filled with coarse sand, broadcast directly, and raked in or scarified gently with sandpaper, soaked in hot water until the water has cooled, then planted. It is best to sow seed directly since lupine do not do well when over-handled (Foster 1977, Schmidt 1980, Link 1993).

Vegetative: Cuttings can be taken from side shoots of hardened stems in the spring (Foster 1977).

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Strickler, D. 1993. Wayside Wildflowers of the Pacific Northwest. Flower Press. Columbia Falls, MT. 272 p.

Lupinus sericeus
Silky lupine

Description:

Silky lupine is a perennial cool-season forb that grows 20-50 cm tall. Stems are simple or branched and arise from a woody caudex. The leaves are mostly basal with 7-9 leaflets. The leaflets are 3-7 cm long, narrow, acute, and densely subappressed-silky on both sides. The racemes are 12-15 cm long with blue to purple flowers on densely appressed-pubescent pedicels. The calyx is also densely silky. The fruit is a pod 2.5-3 cm long containing 2-6 seeds. Silky lupine is eaten by deer and upland game birds. It is also used as both food and cover by small birds and mammals. It is a good species for rehabilitation of disturbed sites due to its ability to fix nitrogen (Peck 1961, Link 1993, Matthews 1993,).

Habitat and Geographic Range:

Silky lupine ranges from British Columbia south through Washington and Oregon on the east side of the Cascade Mountains, to California and Arizona and east into New Mexico, Colorado, South Dakota, Montana, and Alberta. It grows up to 3000 m in elevation. Its habitat include grasslands, sagebrush, mountain brush, and aspen and conifer forests. It can be found on dry, rocky sites on gentle to steep slopes but grows best in dry, sandy-loam, and clayey-loam soils (Matthews 1993).

Propagation:

Seed: Seed matures from early to late August. Seed collection is time-consuming due to the low number of seeds per pod. Seed can be cleaned by running dried pods through a hammermill and passing through a fanning mill. Seed can be stored in a cold dry environment. It may require an insecticide to protect seed from the insect larvae found within the seed. Estimated storage time is 5-10 years without much loss in viability. Link (1993) recommends inoculating the seed with a rhizobium before sowing. It is best to sow seed direct in full sun to partial shade since lupine does not tolerate much handling (Foster 1977, Link 1993, Matthews 1993).

Seeds per pound: ~19,700-42,000 (Link 1993).

Vegetative: Cuttings can be taken from side shoots of hardened stems in the spring (Foster 1977).

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Peck, M.E. 1961. A Manual of the Higher Plants of Oregon. Oregon State University Press. Corvallis, OR. 936 p.

Pachistima myrsinites
Oregon boxwood

Description:

Oregon boxwood is a low growing, many branched, broadleaf evergreen shrub that grows 0.3-1 m tall. The leaves are opposite, 1-3 cm long, oblong and glabrous with serrated margins. The reddish to purple flowers are very small and are found in small clusters in the leaf axils. The fruit is a tiny, two-seeded, berry-like capsule. Oregon boxwood is browsed by deer, elk, moose, mountain sheep, and grouse (Helliwell 1987, Snyder 1991).

Habitat and Geographic Range:

Oregon boxwood ranges from British Columbia south to California and Mexico and east through the Rocky Mountains. It can be found from sea level up to 3350 m in elevation. It is a climax species and tolerates both sun and shade. It grows on well-drained, shallow, gravelly clay and silt loam soils but prefers light to deep shade with a moist atmosphere (Snyder 1991).

Propagation:

Seed: Oregon boxwood fruits from June through September (Snyder 1991). The seed may remain viable for decades (Helliwell 1987).

Vegetative: Oregon boxwood stems can layer and root. The shrub is easily propagated through stem cuttings (Snyder 1991). Cuttings should be taken in the early fall. The nodes are very close, and cuttings only need to be 3-4 nodes long. A slant cut should be made at the bottom and the bottom leaves stripped off. The end should be dipped in a liquid rooting hormone and stuck into a perlite:vermiculite (1:1) growing medium. Plants should be set on a mist bench in a greenhouse at 20%C with low mist. Once rooted, they can be transplanted to a potting media of peat, perlite, and ground bark (Buis 1996).

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Physocarpus malvaceus
MALLOW NINEBARK

DESCRIPTION:

Mallow ninebark is a deciduous shrub which grows 0.5-2 m tall. It has a broad stem structure with grayish bark that shreds on older stems. The leaves are alternate, palmately three- to five-lobed, and doubly serrated at the margins. Flowers are found in a tight, round cluster with five white petals and a brownish yellow center. The fruit is a swollen two- to three-chambered capsule with two to four small seeds per chamber. Mallow ninebark is not an important browse species and is generally avoided. It provides good shelter and cover for many wildlife species from small birds to large mammals when it forms dense thickets (Habeck 1992, Strickler 1993).

HABITAT AND GEOGRAPHIC RANGE:

Mallow ninebark ranges east of the Cascade Mountains from south-central British Columbia to central Oregon, east to southwestern Alberta, Montana, Wyoming, Nevada, and Utah. It can be found at elevations of 1600-3000 m and grows on hillsides, canyons, and grasslands on mesic sites predominantly occupied by ponderosa pine and Douglas-fir. It is found mainly on soils with no exposed rock and with soil textures ranging from sandy loam to silty clay loam (Habeck 1992).

PROPAGATION:

Seed: Fruit ripens from August to early-October when the color turns from pale green to pale brown. Seeds can be collected by hand-picking or shaking onto a dropcloth. They can be dried naturally or with artificial heat, then threshed and cleaned. Dried seeds can be stored at room temperature and remain viable for at least five years. Seed can be sown in the fall and covered with mulch or stratified with a 30-day prechill and sown in the spring. Germination is generally low due to a large number of unsound seed (USDA 1974, Habeck 1992, Link 1993).

Seed per pound: ~756,000 (USDA 1974)

Vegetative: Propagation by cuttings is easier than by seed (USDA 1974). Ninebark can also be propagated using rhizomes. There can be numerous suppressed buds along the entire length of the rhizome axis. The presence of buds throughout the rhizome may permit sprouting at many points given the proper environmental conditions (Habeck 1992).

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Rosa gymnocarpa
Baldhip rose

Description:

Baldhip rose is a slim stemmed, erect, deciduous shrub with many slender, straight prickles that reaches 1.5 m in height. The leaves are alternate, pinnately compound with 5-9 leaflets, 1-4 cm long, doubly serrate, with a pair of wedge-shaped stipules at the base of the rachis. The flowers are small, pink in color, and are usually borne singly. The fruit is a red-orange rose hip and the calyx soon becomes deciduous. The hips are eaten by birds and small mammals (Helliwell 1987).

Habitat and Geographic Range:

Baldhip rose can be found widely from low to high elevations and ranges from southern British Columbia east to northwest Montana, south to southern Idaho, and into central California (Helliwell 1987).

Propagation:

Seed: The hips are collected in August and September by hand picking after the green color turns reddish. The seed can be cleaned by macerating the fruit in water and recovering the seed by flotation. Seed can be stored dry for 2-4 years in sealed containers at 1-3%C. Stored seed must be cold stratified at 4%C for 90 days before planting. Germination is greatest if seeds are sown immediately after cleaning. Seed should be covered with a shallow layer of soil and mulched with sawdust or oat straw (USDA 1974).

Vegetative: Buis (1996) reports poor success with hardwood cuttings and recommends semi-hardwood cuttings. Cuttings should contain 3 to 4 nodes each. The basal end leaves should be stripped and the cutting should be treated with a medium strength rooting hormone, stuck into a perlite:vermiculite (1:1) mixture and set on a misting bench with light mist at 21%C. Once rooted, plants can be moved to a hoop house or shade house.

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Rosa nutkana
Nutka rose

Description:

Nutka rose is a deciduous perennial shrub with erect or trailing stems that reach 1-1.8 m (Reed 1993). The stems have large, curved prickles at the nodes (Helliwell 1987). The leaves are compound with 5 to 7 leaflets (Reed 1993). The leaflets are oval or elliptical, 2.5-3.8 cm long, and serrated from the tip to just past the mid-point. The flowers are 5 cm across, borne singularly, and pink to purple in color (King County 1994). The fruit is a pear-shaped hip, 12-20 mm long, with a persistent calyx (Helliwell 1987, King County 1994). Nutka rose has excellent soil-binding characteristics and it is a good source of food and cover for many wildlife species (Reed 1993, King County 1994).

Habitat and Geographic Range:

Nutka rose ranges from Alaska south to California and east to New Mexico and western Montana. It can be found in floodplains, open streambanks, and meadows. It grows on nitrogen-rich, fresh, moist, well-drained clayey-loam, sandy-loam, or sandy soils in moderately dry to moist climates. Nutka rose is both sun and shade tolerant but produces more fruit as its exposure to light increases (Reed 1993).

Propagation:

Seed: Nutka rose reaches sexual maturity at 2 to 5 years of age with good seed crops every other year. It flowers from May through June and the fruit ripens in early fall and remains on the plant through winter (Reed 1993). Fruit can be collected from August through September and should be either dried and crushed or soaked in water and macerated to remove the seed (King County 1994). The seed require a period of after ripening. If spring sown, a warm stratification followed by a cold stratification is necessary for germination, or they can be sown fresh in the fall. Seed can be sown into propagating flats in a finely milled leat:vermiculite growing media (Buis 1996).

Vegetative: Nutka rose sprouts from the root crown and also grows from small offshoots from the parent plant (Reed 1993, King County 1994).

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Rosa pisocarpa
Cluster rose

Description:

Cluster rose is a slender, erect, shrub reaching 1-4 m in height. The stems are scarcely armed with straight or slightly curved prickles. The leaves are compound, 5-10 cm long, with 5-7 leaflets. The leaflets are oval shaped, dark green above and puberulent beneath. The rachis often has a few prickles. The flowers are borne generally several in a corymb, but sometimes found solitary, 3.5-4.5 cm in diameter with the calyx lobes elongated and smooth or glandular. The petals are broad and deep pink in color with a slight tinge of magenta. The fruit is a hip, globose or broadly ovoid, 1 cm long, with the calyx-lobes persistent (Peck 1961, Gilkey and Dennis 1980).

Habitat and Geographic Range:

Cluster rose ranges from British Columbia south to Oregon and Idaho, and possibly into California and Utah. It is found growing scattered along streams, dry ravines, in thickets and open woods mostly west of the Cascade Mountains (Peck 1961, USDA 1988).

Propagation:

Seed: Seed is collected in the fall by hand. It is best to soak the seed in water for five to seven days in a warm place before cleaning. Cleaning is done by macerating in water and floating away the pulp. Seed requires a period of afterripening. They need a period of warm stratification followed by a period of cold stratification if spring sown, or can be sown fresh in the fall. They can be sown into ray-leech tubes with a standard potting mix and overwintered in a hoop house or outside. If kept outside, they should be mulched with decomposted bigleaf maple (*Acer macrophyllum*) leaves. (Buis 1996).

Vegetative: No information available at this time.

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Rosa Woodsii
Wood's rose

Description:

Wood's rose is a fast-growing, long-lived perennial shrub. It grows from 0.5-2m in height. The leaves are alternate and pinnate with 5-7 obovate to oblong-obovate leaflets, 2-6 cm long with sharply serrated margins. There are usually two stout thorns at the base of each leaf and straight to slightly curved prickles 0.5-1.0 cm long on the stems. The five-petaled flowers are a deep pink or occasionally white. The fruit is a stoney achene 3-4 mm long within a berry-like hip 6-15 mm wide. Leaves are browsed by big game, livestock, porcupines, and beavers. Dried fruits are eaten by many birds and mammals during the winter. Dense thickets are used as nesting and cover for many birds and small mammals. Wood's rose is a good species to plant for erosion control due to its good survivability and revegetation characteristics (Vories 1981, Snyder 1991, Tesky 1992, Strickler 1993).

Habitat and Geographic Range:

Wood's rose ranges from British Columbia to western Ontario and Minnesota, south to Missouri, Nebraska, Arizona, and northern Mexico. Its elevational range is from 1000-3500 m. It grows on a wide range of soil types and textures but prefers a moist, well-drained clay loam, sandy loam, or sandy soil. It can be found on bluffs, dry grassy slopes, and sandhills in the prairies, but is more common on riverbanks and clearings in boreal and subalpine forests. Wood's rose is rarely found where the average precipitation is less than 30 cm and does best in moderate shade to full sun (Tesky 1992, Strickler 1993).

Propagation:

Seed: *Rosa* spp. take 2-5 years before they start flowering and producing seed. The fruit ripens from late-summer through fall. The hips can be hand-picked into a or knocked into hoppers or containers. Seeds are cleaned by macerating the hips in water and floating off the pulp and empty seed. Seed can be stored dry in sealed containers at 1-3%C and maintain viability for 2-5 years. Fresh seed can be sown in the fall while spring-sown seed should undergo a period of warm stratification followed by a period of cold stratification at about 4%C. Recommended planting depth is 0.5-2.0 cm with an oat straw or sawdust mulch (USDA 1974, Vories 1981, Snyder 1991).

Seeds per pound: ~50,000 (USDA 1974)

Vegetative: Wood's rose spreads vegetatively through underground rhizomes, sprouting from root crown, and layering (Tesky 1992). Propagation can be accomplished by division (Snyder 1991). Softwood cuttings 15 cm long can be taken from mid- to late-June into early July, and hardwood cuttings have not proven very successful (Anderson 1996).

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Rubus idaeus
Red raspberry

Description:

Red raspberry is a deciduous shrub with erect stems, reaching 1-2 m tall. The stems originate from a perennial, branching rhizome and contain abundant bristles, prickles, and hairs. Flowering lateral branches are produced during the second year of growth. The leaves are alternate and pinnately compound with 3-7 irregularly shaped, toothed lobes. Small showy perfect white flowers are borne in clusters of one to four in a compound cyme. The fruit is a berry—an aggregate of many, red or pinkish-purple drupelets. The berry is food for birds, squirrels, chipmunks, mice,and racoons. Deer and rabbit browse the leaves and stems (Haeussler et al. 1990).

Habitat and Geographic Range:

Red raspberry ranges from Alaska to Newfoundland, south to North Carolina and Tennessee, and in the West to Arizona, California, and northern Mexico. It is a shade-intolerant species and can be found on disturbed sites in areas ranging from valley bottoms and stream banks to clearings in forests and subalpine elevations. It grows on imperfectly to well-drained sandy loam to silty clay loam, but grows best on moderately well-drained soils (Haeussler et al. 1990, Tirmenstein 1990).

Propagation:

Seed: Most species of raspberry produce good seed crops nearly every year but seed production can vary annually depending on climatic factors and the age of the stems. The fruit of red raspberry ripens from late-June to October and should be hand picked. The seeds are extracted by macerating in water and floating off the pulp and empty seed. Dried seed can be stored at 5%C for several years (USDA 1974). Germination is best when seed is scarified and sown in the fall. Spring-sown seeds require a warm stratification at 20-30%C for 90 days, followed by cold stratification at 2- 5%C for an additional 90 days (Tirmenstein 1990). Germination is improved when seeds are scarified in either sulphuric acid for 20-60 minutes or a 1% solution of sodium hyperchlorite for 7 days. Seed should be sown in drills and lightly covered with soil. Sowing seeds at greater depths with subsequent exposure to light can produce better germination than shallow plantings, possibly due to greater soil moisture (Tirmenstein 1990). Mulching is suggested over winter (USDA 1974).

Vegetative: Natural vegetative regeneration occurs through stolons, rhizomes, and basal stem buds. Dense raspberry thickets form from the roots or stems of parent plants which separate to form individual plants with the deterioration of connecting tissue. The adventitious shoots produced during the growing season elongate, push up through the soil and root. When dormant, the new plants can be dug up and transplanted or held in cold storage until outplanting. Root cuttings can be taken when the plant is dormant if care is taken to prevent drying of the roots before planting (Miller 1993).

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Rubus lasiococcus
Dwarf bramble

Description:

Dwarf bramble is a trailing perennial shrub, approximately 10 cm tall, with slender, unarmed stems that grow up to 2 m long. The leaves are alternate, deciduous with some persisting over winter, 3-lobed, 3-6 cm wide, and strawberry-like. The flowers are white, 1-2 per stalk, with 5-10 mm long petals, and contain many stamens and pistils. The fruit is a bright red aggregation of druplets with many hairs (Helliwell 1987, Pojar and MacKinnon 1994).

Habitat and Geographic Range:

Dwarf bramble grows in moist, shaded woods and open places such as thickets and logged areas. It can be found in the Cascade Mountains north to British Columbia at mid to high elevations (Peck 1961, Helliwell 1987, Pojar and MacKinnon 1994).

Propagation:

Seed: No information available at this time.

Vegetative: Cuttings can be taken from runners during spring to mid-summer. Each cutting should have at least 2 nodes. The basal end should be dipped into a light strength powered rooting hormone and stuck into a perlite:vermiculite (1:1) mixture. These should be set on a mist bench at 21%C and not allowed to get too wet. Once they have established roots, they can be transplanted to a regular potting soil and moved to a greenhouse and placed in a heavily shaded area (Buis 1996).

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Rubus parvaflorus
THIMBLEBERRY

DESCRIPTION:

Thimbleberry is a deciduous, rhizomatous shrub growing up to 2.5 m tall. This species sprouts short-lived, erect, stems that contain no prickles. The leaves are alternate, grow up to 25 cm, have 3-7 toothed lobes and appear maple-shaped. They have a soft crinkly surface and finely pubescent on both sides. The flowers are borne with 3-11 in a long-stemmed terminal cluster, up to 4 cm across, with white crinkled petals. The fruit is a shallowly domed aggregate of small, red, hairy, drupelets. The leaves, stem, and berries are browse for the black-tailed deer, and the berries are eaten by many different birds (Haeussler et al 1990, Pojar and MacKinnon 1994).

HABITAT AND GEOGRAPHIC RANGE:

Thimbleberry ranges from Alaska to California, east to New Mexico, South Dakota, Michigan, and into western Ontario. It can be found at elevations up to 2700 m, but is more common up to 2100 m in the Pacific Northwest. It grows in moist, shaded places such as those along streams, moist draws, wooded hillsides, avalanche tracks, and open woods. It prefers a sandy loam soil that is rich in humus, but also grows on rocky sites with thin soils (USDA 1988, Pojar and MacKinnon 1994).

PROPAGATION:

Seed: Seed should be collected before or as soon as the berries are ripe. They can be placed into a container of water to soak for a few days before macerating. Seed requires no pretreatment. It can be stored damp in a refrigerator over the winter and sown in February in a standard potting mix and placed in a hoop house (Buis 1996)

Cuttings: Thimbleberry can be propagated by cuttings and rhizomes. (Haeussler et al. 1990).

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Sorbus sitchensis
Sitka mountain-ash

Description:

Sitka mountain-ash is a large, deciduous shrub, or occasionally a small tree, growing up to 9 m with a round, open crown. The bark is light gray, smooth and scaling with age. The leaves are alternate, pinnately compound, with 7-11 lanceolate, sharply serrate leaflets. White flowers are borne in terminal corymbs with 15 to 60 flowers per head. The bright red fruit is a round berry, 0.6-1.2 cm in diameter, found in clusters at the end of the branchlet, and contain 1-2 ovate shaped seeds. The berries supply food for many birds and small mammals. The twigs are browsed by deer, moose, and elk, and the berries, leaves, and stems are eaten by bears. Sitka mountain-ash can be used for streambank rehabilitation but may produce allelopathic substances that inhibit the growth of Douglas-fir seedlings (Elias 1980, Matthews 1993).

Habitat and Geographic Range:

Sitka mountain-ash grows on moist, rich, well-drained soils along stream borders or rocky hillsides, and is usually found among conifers. It can be found at elevations ranging from 760-3050 m from Alaska to central California, and east into northern Idaho and northwestern Montana (Elias 1980, Matthews 1993).

Propagation:

Seed: Sitka mountain-ash begins producing seed after about 15 years and usually produces a good seed crop every year. Fruit ripens from August to October and should be picked or shaken from the tree soon after to prevent losses to birds. Seed can be extracted using a macerator and pulp can be removed by floatation, screening, or skimming. Seed should be dried and cleaned for storage. Seed stored in sealed containers at 6-8% moisture content and 1-3%C can be kept for up to 8 years with little loss of viability. Unstratified seed should be sown in the fall or early-winter. Spring-sown seed requires a cold stratification of 90-140 days at 1-5%C in moist peat moss or soil. Cleaned seed can be sown in drills while berries or dried pulp must be broadcast. Seed sown from berries have a slower and less successful germination rate. When outplanting, 1-1 stock is preferred, but 2-0 is acceptable (USDA 1974, Matthews 1993).

Seeds per pound: ~140,000 (USDA 1974)

Vegetative: It has been reported that American mountain-ash (*S. americana*), a closely-related species, sprouts from the stump when top-killed (Matthews 1993). Sitka mountain-ash appears difficult to start from cuttings and is generally not successful (Foster 1977, Kruckeberg 1982).

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Spiraea betulifolia
Birchleaf spirea

Description:

Birchleaf spirea, also called white spirea, is a deciduous, rhizomatous shrub that grows 15-60 cm high. The bark is scaly and cinnamon-brown in color. The leaves are alternate, 2.5-5 cm long, oval, and serrated on the ends. The white to pale pink flowers are found in a dense, flat-topped cluster and appear fuzzy due to many protruding stamens. These turn brown shortly after fertilization and yield the small, dry, podlike fruit which contain the seed. Birchleaf spirea is not an important browse species (Habeck 1991, Strickler 1993).

Habitat and Geographic Range:

Birchleaf spirea ranges from eastern Oregon and Washington through southern Idaho, east to north-central Wyoming, western Montana, and in the Black Hills of South Dakota. In Canada it occurs in southern British Columbia, southern Saskatchewan, and eastern Alberta. It grows from 300-1200 m in dry forests and up to 3000 m in wetter forests. It can be found on brushy or open slopes and scattered to dense forests. It grows on dry, rocky sites and in forest habitats with parent material ranging from limestone to quartz. This species is good for watershed rehabilitation (USDA 1974, Habeck 1991, Strickler 1993).

Propagation:

Seed: Birchleaf spirea shrubs growing in full sun will be those that produce seed. The fruit ripens from mid-July to early-September and seeds disseminate during October. The seed requires no stratification and can germinate at 0-2%C when conditions are maintained for more than 120 days. Seed can therefore be sown in the fall and overwintered (USDA 1974).

Vegetative: Cuttings should be taken in mid-June, dipped in a 3000 ppm IBA-talc, and stuck into a sandy soil in an outdoor frame with bottom heat. Cuttings can also be taken in early-August but survival is not as high (Dirr and Heuser 1987). White spiraea is rhizomatous and usually grows in extensive colonies. After a disturbance, birchleaf spirea will usually resprout within the next growing season. Buds are well distributed along the entire length of the rhizome. As a result, any section of the rhizome is probably capable of generating new stems if it is large enough to provide the carbohydrates necessary for sprouting. White spiraea also appears capable of some layering from aerial stems (Habeck 1991).

Disease:

Spireas can be infected by aphids that are usually found on the shoot tips or in the flower clusters. Aphids cause leaf curling and can be dislodged with a high pressure water spray from a garden hose. Leaves being rolled and webbed is a sign of oblique-banded leaf rollers and can be hand-picked off infested leaves. Scales can also be a problem. Sprays of dormant oil in the spring will help minimize injury to predators that help control scales.

Fire blight can infect spireas and the use of high nitrogen fertilizers makes them more susceptible. Symptoms include scorched looking leaves, die back of twig tips, and dead leaves hanging on blighted branches. There is no satisfactory chemical control and infected branches should be pruned out (MSUE 1996).

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Spiraea douglasii
Douglas' spirea

Description:

Douglas' spirea, also called hardhack, is a many-branched, erect shrub reaching 0.5-2 m in height. The leaves are alternate, oblong-elliptical, oblong-ovate, or elliptical in shape, 3-7.5 cm long, with serrated margins along the upper 0.6-1.3 cm. The small flowers are pink or reddish in color, borne in dense elongated terminal clusters, and appear fuzzy due to the many protruding stamens. The fruit is a smooth follicle that persists through the winter. Douglas' spirea is browse for deer and occasionally for livestock. It is a good species for riparian revegetation programs (Helliwell 1987, Randall et al. 1994, Esser 1995).

Habitat and Geographic Range:

Douglas' spirea ranges from Alaska south into northern California and east to western Montana. Its elevational range is from 650-2050 m and grows best on moist to semi-wet loam and sandy loam soils with good drainage. It can also be found growing on silty clay, clay loam, and gravelly substrates and is tolerant of permanently water-logged soils. It occurs on moist sites and riparian areas including wet meadows, floodplains, bogs, swamps, and along streams, rivers, lakes, and springs. It is generally a shade intolerant species but frequently forms dense thickets in riparian areas (Esser 1995).

Propagation:

Seed: Douglas' spirea flowers from June to September. The seeds are approximately 2 mm long (Esser 1995). Fresh seed germinates easily without any pretreatment and dry seed may require one to two months of cold stratification (Darris et al. 1994)

Vegetative: Cuttings should be collected in the fall, making sure there is a bud on the length of cutting. A slice cut should be made at the bottom. Cuttings can then be placed in a bucket of water in a cooler for a few weeks, dripped off, then placed in a plastic bag in a cooler until April. From there they should be dipped in a rooting hormone and planted in a 50:50 peat:perolite mixture (Jebb 1995). Hardwood cuttings 15-20 cm long can be taken during December and January, treated with a rooting hormone, and stuck into a moist potting soil. Cuttings should be placed in a greenhouse with an overhead mist system and bottom heat. After hardening off, plants can be outplanted by late-March or April (Darris et al. 1994). Douglas' spirea is a rhizomatous shrub that often forms dense colonies. It will sprout from the stem base and root crown following disturbance (Esser 1995).

Disease:

Aphids can infect spireas and are usually found on the shoot tips or in the flower clusters. They cause leaf curling and can be dislodged with a high pressure water spray from a garden hose. Rolled and webbed leaves is a sign of oblique-banded leaf rollers and they can be hand-picked off infested leaves. Scales can also be a problem. Sprays of dormant oil in the spring will help minimize injury to predators that help control scales. Fire blight can

infect spireas and the use of high nitrogen fertilizers makes them more susceptible. Symptoms include scorched looking leaves, die back of twig tips, and dead leaves hanging on blighted branches. There is no satisfactory chemical control and infected branches should be pruned out (MSUE 1996).

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Xerophyllum tenax
Common Beargrass

Description:

Common beargrass is a rigid, tufted, evergreen, herbaceous perennial that grows 1-2 m in height. The wiry leaves are grasslike with rough edges, and are 30-90 cm long. The flower clusters occur at the top of the stalk, and have a broad base that tapers to a blunt point. Hundreds of white flowers are crowded together on slender, elongated white pedicles. The flowers have a heavy, slightly unpleasant fragrance and bloom once every 5-7 years. The fruit is a small three-lobed capsule containing several 4 mm long seeds. The flower stalks are eaten by deer, elk, and other big game animals. Common beargrass has high biomass production and is good for long-term revegetation and erosion control. Coastal and Southwest tribes use the leaves in basketweaving (Dayton 1960, Crane 1990).

Habitat and Geographic Range:

Common beargrass can be found in all soil types ranging from basaltic lava to serpentine to granite and quartzite. It prefers a well-drained soil and grows on xeric to subxeric and submesic to mesic sites. It is moderately shade-tolerant and can be found in the understory of cool subalpine forests or in the open on high ridges and slopes and in mountain meadows. It is usually found between 900-2450 m in elevation but grows from sea level up to 2700 m. It ranges from central California north to British Columbia east to southwestern Alberta, and south through the Rocky Mountains into Idaho, Montana, and northwestern Wyoming (Dayton 1960, Crane 1990).

Propagation:

Seed: Common beargrass blooms from July to August and fruiting occurs during August and September. Seed can be collected by hand and sown directly in the fall (Anderson 1996). For spring sowing, seed requires at least 12-16 weeks of cold stratification and germinates best in vermiculite (Crane 1990, Time Life, Inc 1996).

Seeds per pound: ~830,000 (Crane 1990).

Vegetative: Vegetative reproduction occurs by offshoots of the rhizome. These offshoots can be divided in the spring or fall and replanted (Crane 1990, Time Life, Inc. 1996).

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Time Life, Inc. [Monograph Online]. Electronic Encyclopedia. Virtual Garden. http://pathfinder.com/@@yJuDF4F68wAAQAJ6/cgi-bin/VG/vg. Accessed June 25, 1996.

GLOSSARY

achene

achene: a small, dry, indehiscent, one-seeded fruit; unwinged but often plumose

acorn: a nut topped with a scaly or bristly cap

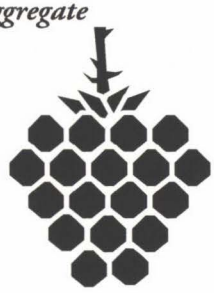
acuminate: gradually tapering to a sharp point

acute: terminating in a distinct but not protracted point, the converging edges separated by an angle less than 90 degrees

adventitious: arising in abnormal positions, e.g. roots arising from the shoot system, buds arising elsewhere than in axils of leaves

aggregate: collected together in tufts, groups, or bunches; applied especially to inflorescences and fruits

aggregate



alternate: refers to leaf arrangement; single leaves alternate along the length of the twig

angiosperm: a seed-bearing plant whose seeds develop within an enclosed ovary

annual: a plant that completes its lifecycle in a single growing season

anther: the pollen-bearing portion of the stamen

appressed: pressed closely against but not united with

aristate: awned; provided with a bristle at the end or at the back or edge of an organ; in grasses, applies especially to the awns at the end of the bracts of the spikelet

articulate: jointed; joined by a line of demarcation between two parts which at maturity separate by a clean-cut scar

asexual: not forming part of a cycle which involves fertilization and meiosis

alternate

auxins: hormones produced primarily in the plant shoot meristems that stimulate root initiation and development

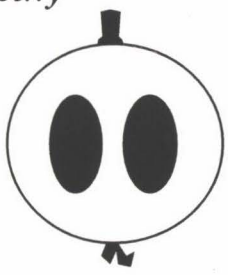
awn: a slender bristle at the end or on the back or edge of an organ; in grasses, the awn is usually a continuation of the midnerve (and sometimes the lateral nerves) of the glumes or lemmas

axil: the angle between a leaf and the stem to which it attaches; adj. axillary

basal: relating to, or situated at the base

basal sprouting: occurs when a plant send up new shoots from buds located either at the base of the stem or on below-ground burls

berry



berry: a several-seeded indehiscent fruit, the outer and inner walls of which are fleshy, with the seeds embedded in the pulpy mass

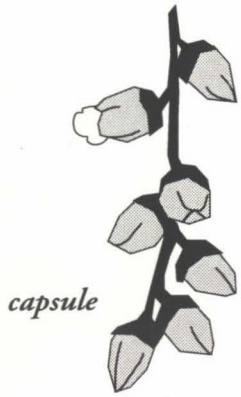
biennial: a plant that completes its lifecycle in two growing seasons

biternate: having double groups of three leaflets

blade: the expanded portion of the leaf located above the sheath

bract: a leaf-like structure, different in form from the foliage leaves and without an axillary bud, associated with an inflorescence or flower

bud: small axillary or terminal structure on the stem or branch, consisting of embryonic foliage or floral leaves



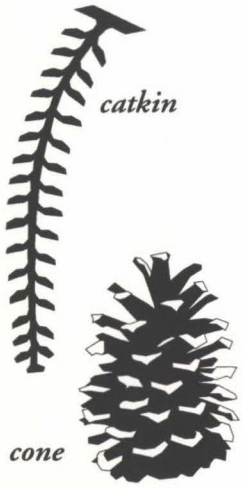
bur: a rough or prickly propagule consisting of a seed or fruit and associated floral parts of bracts

callus: a protruding mass of hardened tissue, often formed after an injury but sometimes a regular feature of the plant; e.g. on the axis of the spikelet of some grasses

capsule: dry, dehiscent fruit; the product of a compound pistil splitting along two or more sutures

catkin (ament): a long, narrow inflorescence composed of numerous flowers; typically unisexual (all female or all male); may be erect or pendulous; wind pollinated

chaff: thin, membranous scales or bracts; thin, dry unfertilized ovules among the fully developed seeds of a fruit



compound: refers to leaf composition; more than one leaf blade shares a common stem; the individual leaves are termed leaflets

cone: woody, leathery, or semi-fleshy scales spirally arranged, or alternating in pairs at right angles, and inserted on a central axis; each fertile scale bears one or more seeds; also called a strobile

conifer: a plant that bears its seed inside woody or semi-woody strobiles commonly called cones

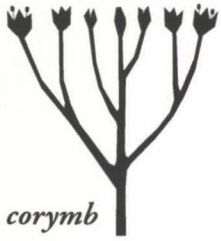
corymb: a racemose inflorescence in which the pedicels of the lower flowers are longer than those of the flowers above, bringing all flowers to about the same level

cotyledon: the primary leaf or an embryo

crenate: refers to a leaf margin with rounded to blunt teeth

crown: the part of a tree or shrub above the level of the lowest branch

culm: The jointed stem of grasses, sedges, or rushes bearing the inflorescence



cuneate: wedge-shaped with the narrow part below

cuttings: a vegetative portion of a plant which is separated from the parent plant and cultured to develop new roots and shoots; different types of cuttings are taken (leaf, nodal, basal, softwood, hardwood) based on the rooting capabilities of the parent species

damping-off: a fungal disease that attacks new seedlings as they first emerge from the soil; the condition is indicated by the top of the seedling suddenly wilting or leaning over

deciduous: not persistent; the foliage falls seasonally

decumbent: lying on the ground at the base, but rising at the tip

dehiscent: refers to fruit which break open at maturity to release the contents (i.e. seeds)

deltoid: triangular

dentate: refers to a leaf margin with sharp teeth pointing outward

dioecious: having the female and male reproductive structures on separate plants

dormancy: general term for instances when a living tissue that is predisposed to grow does not do so; the seedcoat can impose dormancy through its impermeability to water or gas exchange or mechanical restrictions on growth of the embryo; agents or conditions within the mature seed can also maintain dormancy until specific environmental requirements are met

doubly serrate: refers to a leaf margin which is coarsely serrate with the teeth margins again serrated

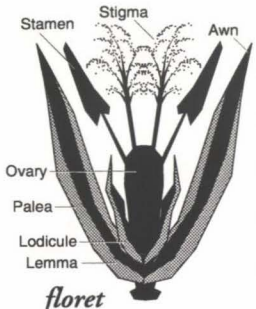
entire

drupe: a mostly one-seeded fleshy fruit, usually the product of a simple pistil, the outer wall fleshy, the inner wall bony

ecotype: physiological or morphological characteristics resulting from adaptation to specific environmental conditions which may be described by geographic location, climate, altitude, soil condition, etc.

entire: refers to a leaf margin which is smooth, without lobes or teeth

epicormic: of buds, shoots or flowers, borne on the old wood of trees (applied especially to shoots arising from dormant buds after injury or fire)



floret
(grass flower)

evergreen: bearing green leaves throughout the year

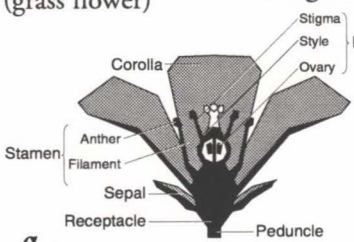
filament: that part of the stamen which supports the anther

floret: a grass flower, together with the lemma and palea that enclose it

flower: the reproductive portion of the plant, consisting of stamens, pistils, or both

follicle: a dry, dehiscent, multiple-seeded fruit that splits open along one side at maturity

forage: the leaves and other plant parts eaten by herbivorous animals



flower

fruit: the seed bearing structure in angiosperms formed from the ovary after flowering

genotype: the total complement of hereditary factors (genes) acquired by an organism from its parents and available for transmission to its offspring

germination: the initial emergence of roots, shoots, and leaves from a seed usually in response to favorable external conditions (e.g. temperature, moisture, and oxygen) following a period of dormancy

glabrous: without hairs of any sort

follicle

grass: monocotyledonous herbaceous plants of the family *Poaceae* (*Gramineae* family)

glaucous: covered with a powdery or waxy coating

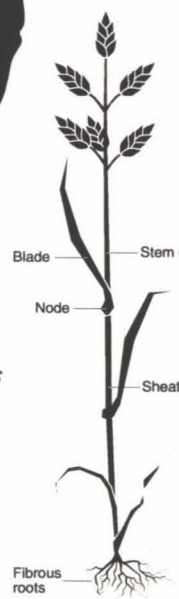
glume: a bract at the base of the spikelet or in the inflorescence of a grass, sedge, or similar plant

gymnosperm: a seed plant, mostly trees, which bear seeds not enclosed inside ovaries

habitat: the physical environment in which a plant or animal lives

hand-stripping: rubbing with the palm of the hand

hardwood cutting: a stem cutting taken from a deciduous plant after it has lost its leaves and before spring growth ensues; a stem cutting taken from a mature shoot of an evergreen plant during dormancy



grass

head: densely packed cluster of stalkless flowers

heel-cutting: branchlet detached at juncture of main branch; the "heel" when trimmed forms callus tissue and roots in proper soil

herbaceous: not woody, applied to a plant whose aboveground parts do not form hard wood

hip: fruit consisting of the fleshy floral tube surrounding the mature ovaries, such as a *Rosa*

IBA: indolebutryic acid, a synthetic auxin which is added to the base of cuttings to promote optimum rooting

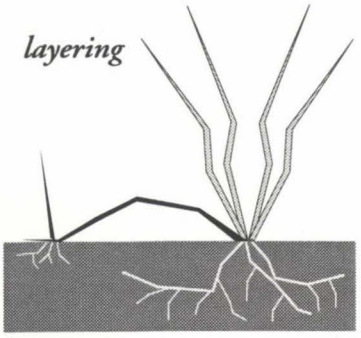
indehiscent: refers to dry fruits that normally do not split open at maturity

inflorescence: the group or arrangement in which flowers are borne on a plant

innovation: the basal shoot of a perennial grass

lanceolate

internode: the portion of a stem between two successive leaves or leaf pairs (or branches of an inflorescence)



involute: refers to blades which are rolled inward from the edges, the upper surface within

keel: the sharp fold at the back of a compressed sheath, blade, glume, or lemma; the palea and sometimes the glumes and lemmas may be two-keeled

lanceolate: lance-shaped; several times longer than broad, widest at a point about one-third of the distance from the base; narrowed at the ends

lammas: growth which develops in the late summer from the current season's bud

layering: a branch's production of roots when it comes into long-term contact with the soil or other rooting medium; layering branches typically have the ability to grow independently when separated from their parents

legume: dry, multi-seeded, dehiscent fruit; the product of a simple pistil splitting along two lines of suture

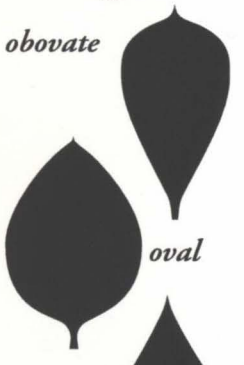
lemma: the outer or upper scale-like bract of a spikelet enclosing a grass flower

lenticels: round, oval or slitlike pores on the twigs, branches and stems of a plant which are concerned with aeration

ligule: the thin appendage or ring of hairs on the inside of a leaf at the junction of sheath and blade

linear: long and narrow with margins parallel or nearly so

lobed: refers to a leaf margin which is divided into lobes separated by rounded sinuses which extend from one-third to one-half of the distance between margin and midrib



maceration: a process for removing the soft, pulpy tissue from fleshy fruits

margin: the edge of a leaf or leaflet

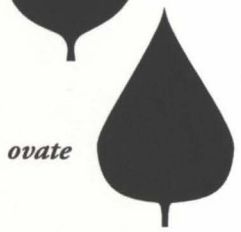
monoecious: having the female and male reproductive structures in separate flowers but on the same plant

mulch: any material such as straw, sawdust, leaves, and plastic film that is spread upon the surface of the soil to protect the soil and plant roots from the effects of rain, soil crusting, freezing, evaporation, etc.

mycorrhiza: a symbiotic union between a fungus and a plant root

nerve: the vascular veins (mostly longitudinal) of the blades, glumes, and lemmas

node: a joint on the stem at which leaves, bracts, or branches are produced



nut: a dry, one-seeded indehiscent fruit with a bony, woody, leathery, or papery wall, and usually partially or wholly encased in a husk

oblanceolate: inversely lanceolate

oblong: longer than broad, and with sides nearly parallel

obovate: inversely ovate

opposite: refers to leaf arrangement; single leaves are borne at the same height on the twig but are attached on opposite sides

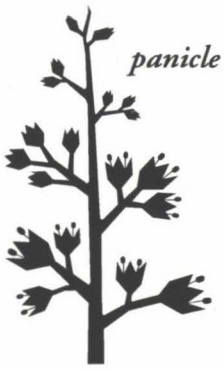
oval: broadly elliptical, with the width greater than one-half the length

ovary: the basal portion of a flower's pistil which bears the ovules that develop into seeds

ovate: egg-shaped, with the broadest part near the base

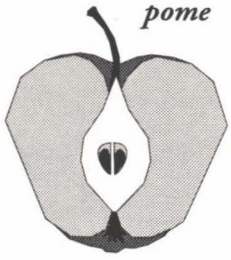
palea: the inner or upper scale-like bract of a floret

palmately compound



panicle

pinnately compound



pome

raceme

palmate: refers to compound leaf arrangement or leaf venation; all leaflets/veins arise from a common point

panicle: a compound raceme; an indeterminate inflorescence in which the flowers are borne on branches of the main axis or on further branches of these

pedicel: the stalk or stem of a spikelet, the opposite of sessile

peduncle: a primary flower stalk supporting either a cluster or a single flower

pendent: suspended or hanging, nodding

perennial: a plant that lives for more than two growing seasons

perigynium: a sac-like bract enclosing the carpel in the genus *Carex*

perlite: an inorganic material used in growing media to promote drainage and porosity; an alumino-silicate mineral treated with heat and crushed to produce white, lightweight particles

persistent: remaining attached, either after other parts have been shed, or for a considerable period

petal: usually the showy, colored parts of a flower

petiole: the stem of a leaf or leaflet

phenotype: the physical characteristics of an organism; the outward expression of characteristics conferred on an organixm by its genotype and influenced by its environment

pilose: pubescent with soft straight hairs

pinnate: refers to compound leaf arrangement or leaf venation; all leaflets/veins arise from a separate point

pioneer: a plant capable of invading newly exposed soil surfaces and persisting until supplanted by successor species

pistil: the female part of a flower, composed of ovary, stigma, and style

pith: the central region of a stem, inside the vascular cylinder

pollination: the transfer of pollen from the male organ, where it is formed, to the receptive region of the female organ, e.g. from anther to stigma

pome: fleshy fruit; the product of a compound pistil, the outer ovary wall fleshy, the wall papery or cartilaginous, and encasing numerous seeds

propagule: a structure with the capacity to give rise to a new plant, e.g. a seed, a spore, part of the vegetative body capable of independent growth if detached from the parent

pubescent: covered with short, soft hairs

raceme: an inflorescence with stalked spikelets borne along a single axis

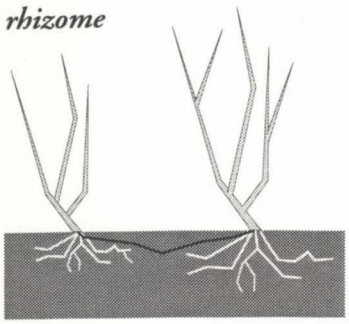
rachilla: a small rachis applied especially to the axis of a spikelet

rachis: the axil of a spike or raceme; the stem of a compound leaf

rhizome: an underground stem, usually growing horizontally, from which roots and shoots emerge along the internodes; usually persists from season to season

root: the part of the plant below ground that takes up water and nutrients from the soil

rhizome



rooting hormone: see "auxins"

root suckering: the sprouting of new shoots from stored or adventitious buds along a plant's root system when the plant is disturbed

rosette: a circular arrangement of leaves, usually at or near ground level

runner: an above ground stem that creeps along the ground, and from which roots and shoots emerge at the nodes; also called stolon

samara: a dry, one-seeded, indehiscent fruit with a wing attached

scabrous: covered with minute points, teeth, or very short stiff hairs which make it rough to the touch

samara

scarification: the process of mechanically or chemically breaking the hard exterior coat of a seed in order to facilitate the penetration of water and atmospheric gases

seed: a propagating organ formed in the sexual reproductive cycle of gymnosperms and angiosperms, consisting of a protective coat enclosing an embryo and food reserves

senescent: refers to aging and decay of a plant and its parts (e.g. leaves of deciduous plants)

sepal: a member of the outer whorl of non-fertile parts surrounding the fertile organs of a flower

serrate

sessil: without a pedicel or stalk, the opposite of pediceled

serrate: refers to a leaf margin with sharp teeth pointing toward the apex

sheath: The basal part of the leaf that wraps around the stem and holds it in place

shrub: a woody plant less than 5 m high either without a distinct main axis, or with branches persisting on the main axis almost to its base

simple: refers to leaf composition; there is but one leaf blade on the petiole

simple

softwood cutting: a stem cutting taken from emerging plant shoots

spike: an unbranched inflorescence composed of stalkless flowers arranged on a single axis: also a general term for grass flowers

spikelet: an individual grass flower; most inflorescences are composed of many spikelets

stamen: the male organ of a flower, composed of anther and filament

sticking: placing a cutting into the propagation medium

stigma: that part of the pistil which receives the pollen

stolon: an aboveground stem that creeps along the ground, producing roots and new plant at the nodes; also called a runner; see layering

stratification: pregerminative treatment of seeds to break dormancy in seeds and to promote rapid uniform; accomplished by exposure to heat or cold, soaking, or other treatment of the seed

strobile

strobile: the reproductive structure of a gymnosperm (commonly called a cone); also, a dry, composite fruit in an angiosperm in which the individual fruits are achenes (e.g. alder)

style: that part of the pistil which connects the stigma with the ovary

terminal: at the end or top

tolerance: the ability of an organism to tolerate or withstand particular environmental conditions (e.g. shade, drought, etc.)

umbel

whorl

tree: a woody plant at least 5 m high, with a main axis the lower part of which is usually unbranched

trifoliate: describes leaves divided into threes

umbel: an indeterminate inflorescence consisting of several pedicelled flowers all attached at the same point on the peduncle

vegetative: refers to the leaves, stems, and roots of the plant as contrasted with the reproductive parts, such as flowers or cones

vegetative propagation: asexual reproduction; the production of new individuals without genetic recombination ("parents" and "offspring" are genetically identical); some woody plants have the ability to produce new, genetically identical individuals through processes such as rhizome production, layering, basal sprouting, root suckering, and stolons; human-assisted techniques include grafting, rooted cuttings, and tissue culture

vermiculite: a lightweight, inorganic material with a high water and nutrient holding capacity used for cultivating plants; a heat-treated aluminum-iron-magnesium silicate mineral that consists of a series of thin, parallel plates

viability: capacity of a seed to germinate

villous: pubescent with long soft hairs

whorl: cyclic arrangement of appendages at a node

wing: a membrane expansion of a fruit or seed which aids in dispersal

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